Instruction Manual
IM-106-880C, OI
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Hazardous Area
OCX 8800
Oxygen/Combustibles Transmitter

ROSEMOUNT® Analytical

http://www.raihome.com

EMERSON™ Process Management

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Hazardous Area Oxygen/Combustibles Transmitter

ESSENTIAL INSTRUCTIONS

READ THIS PAGE BEFORE PROCEEDING!

Emerson Process Management designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you **MUST properly install, use, and maintain them** to ensure they continue to operate within their normal specifications. The following instructions **MUST be adhered to** and integrated into your safety program when installing, using, and maintaining Emerson's Rosemount Analytical products. Failure to follow the proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.

- **Read all instructions** prior to installing, operating, and servicing the product.
- If you do not understand any of the instructions, **contact your Emerson Process Management representative** for clarification.
- **Follow all warnings, cautions, and instructions** marked on and supplied with the product.
- **Inform and educate your personnel in the proper installation, operation, and maintenance of the product**.
- **Install your equipment as specified in the Installation Instructions of the appropriate Instruction Manual and per applicable local and national codes.** Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, **use qualified personnel** to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Emerson Process Management. Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, **and VOID YOUR WARRANTY**. Look-alike substitutions may result in fire, electrical hazards, or improper operation.
- **Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.**

The information contained in this document is subject to change without notice.

⚠CAUTION

If a Model 375 Field Communicator is used with this unit, the software within the Model 375 may require modification. If a software modification is required, please contact your local Emerson Process Management Service Group or National Response Center at 1-800-654-7768.

Section i Introduction

Preface . . . . . page iii
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PREFACE

The purpose of this manual is to provide a comprehensive understanding of the Hazardous Area OCX 8800 components, functions, installation, and maintenance.

We recommend that you thoroughly familiarize yourself with the Introduction and Installation sections before installing your transmitter.

The introduction presents the basic principles of the transmitter along with its performance characteristics and components. The remaining sections contain detailed procedures and information necessary to install and service the transmitter.

Before contacting Emerson Process Management concerning any questions, first consult this manual. It describes most situations encountered in your equipment's operation and details necessary action.

DEFINITIONS

The following definitions apply to WARNINGS, CAUTIONS, and NOTES found throughout this publication.

⚠WARNING

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in injury, death, or long-term health hazards of personnel.

⚠CAUTION

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in damage to or destruction of equipment, or loss of effectiveness.

NOTE
Highlights an essential operating procedure, condition, or statement.

SYMBOLS

⏚ : EARTH (GROUND) TERMINAL

⏚ : PROTECTIVE CONDUCTOR TERMINAL

⚠ : RISK OF ELECTRICAL SHOCK

⚠ : WARNING: REFER TO INSTRUCTION MANUAL

NOTE TO USERS

The number in the lower right corner of each illustration in this publication is a manual illustration number. It is not a part number, and is not related to the illustration in any technical manner.

NOTE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

Section 1 Description and Specifications

Component Checklist . . . . . page 1-1
System Overview . . . . . page 1-3
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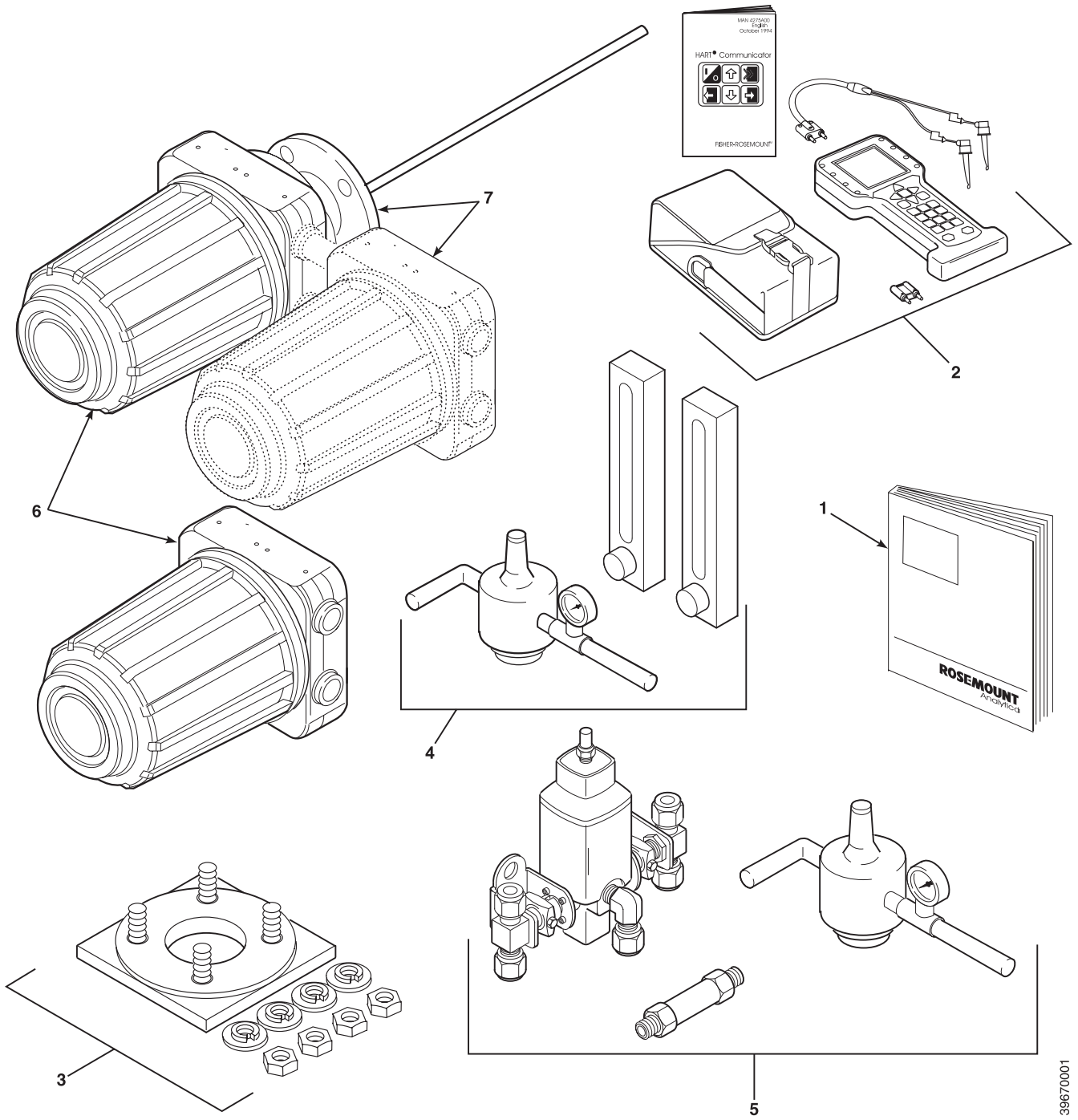
Product Matrix - Hazardous Area OCX 8800 . . . . . page 1-14

COMPONENT CHECKLIST

A typical Hazardous Area OCX 8800 Oxygen/Combustibles Transmitter package should contain the items shown in Figure 1-1.

Use the product matrix in Table 1-1 at the end of this section to verify your order number. The first part of the matrix defines the model. The last part defines the various options and features of the Hazardous Area OCX 8800. Check the model number against the transmitter features and options, making sure options specified by this number are on or included with the unit. Use this complete model number for any correspondence with Emerson Process Management. A list of accessories for use with the Hazardous Area OCX 8800 is provided in Table 1-2.

Figure 1-1. Typical System Package



1. Instruction Manual
2. Field Communicator Package (optional)
3. Adapter Plate with Mounting Hardware and Gasket
4. Reference Air and Calibration Set (optional)
5. Blowback Hardware (optional)
6. Hazardous Area OCX 8800 with Remote Electronics
7. Hazardous Area OCX 8800 with Integral Electronics

SYSTEM OVERVIEW

Scope

This Instruction Manual supplies details needed to install, startup, operate, and maintain the Hazardous Area OCX 8800. Signal conditioning electronics outputs a digital signal representing oxygen (O_2) and combustibles (COe) values. This information, plus additional details, can be accessed with the 375 Field communicator or Emerson Process Management AMS software. The optional local operator interface (LOI) also provides a communications interface with the electronics.

System Description

The Hazardous Area OCX 8800 is designed to measure oxygen and combustible concentrations in flue gas temperatures up to 2600°F (1427°C). Electrical connections, power and communications are made through two 3/4 NPT ports in the flameproof electronics enclosure using fittings and cables provided by the customer. Cable installation must meet NEC, IEC and/or other applicable national or local codes for Class I, Zone 1, Group IIB +H2 T3/T6 permanently mounted equipment. The transmitter is close coupled to the process and requires minimal sample conditioning requirements.

The equipment measures oxygen percentage by reading the voltage developed across a heated electrochemical cell, which consists of a small yttria-stabilized, zirconia disc. Both sides of the disc are coated with porous metal electrodes. When operated at the proper temperature, the millivolt output of the cell is given by the following Nernst equation:

$$EMF = KT \log10 (P_1/P_2) + C$$

Where:

1. P_2 is the partial pressure of the oxygen in the measured gas on one side of the cell.
2. P_1 is the partial pressure of the oxygen in the reference air on the opposite side of the cell.
3. T is the absolute temperature.
4. C is the cell constant.
5. K is an arithmetic constant.

NOTE
For best results, use clean, dry instrument air (20.95% oxygen) as the reference air.

When the cell is at operating temperature and there are unequal oxygen concentrations across the cell, oxygen ions will travel from the high oxygen partial pressure side to the low oxygen partial pressure side of the cell. The resulting logarithmic output voltage is approximately 50 mV per decade. The output is proportional to the inverse logarithm of the oxygen concentration. Therefore, the output signal increases as the oxygen concentration of the sample gas decreases. This characteristic enables the Hazardous Area OCX 8800 to provide exceptional sensitivity at low oxygen concentrations.

The Hazardous Area OCX 8800 measures net oxygen concentration in the presence of all the products of combustion, including water vapor. Therefore, it may be considered an analysis on a "wet" basis. In comparison with older methods, such as the portable apparatus, which provides an analysis on a "dry" gas basis, the "wet" analysis will, in general, indicate a lower percentage of oxygen. The difference will be proportional to the water content of the sampled gas stream.

The Hazardous Area OCX 8800 combustibles sensor is a catalytic sensor consisting of two Resistance Devices (RTD). One RTD is the reference element covered with an inert coating. The other RTD element is active, coated with a catalyst. As the sample gases flow by the sensor, the combustible gases oxidize on the surface of the active element. The oxidation that occurs produces heat and a temperature rise in the active element. The temperature difference produces a resistance relationship between the two elements that is directly proportional to the concentration of combustibles in the sample gases.

The catalyst is specifically designed to detect carbon monoxide (CO), but the sensor responds to other combustible gases. The sensor is calibrated using CO, thus the output should be expressed in terms of CO. However, since the sensor detects other combustible gases, the output cannot just be labeled CO. The response of the sensor to other combustible gases gives an output that is equivalent to the sensor detecting CO.

The term COe is used in this manual to describe the sensor output. This term indicates that the sensor is calibrated in terms of CO, and that the sensor output is equivalent to CO but not specific to CO.

Dilution air is provided to the COe sensor to ensure there is adequate oxygen to fully oxidize any combustible gases regardless of the concentration of oxygen in the process.

System Configuration

Transmitters are available in four lengths, giving the user the flexibility to use a penetration appropriate to the size of the stack or duct. The length options are 18 in. (457 mm), 3 ft (0.91 m), 6 ft (1.83 m), or 9 ft (2.7 m). Probes are available in three material options, 316L stainless steel, Inconel 600, and ceramic to accommodate higher temperatures.

The electronics are contained in a separate housing from the sensors. When the transmitter is configured with the integral electronics option the electronics and sensor housings are mounted as a unit at the stack mounting flange. When the transmitter is configured with the remote electronics option the electronics are contained in a separate housing from the sensors. The electronics housing may be mounted up to 150 feet from the sensor housing.

The electronics control both sensor temperatures and provide output signals in one of two ways:

1. Individual 4-20 ma isolated outputs that are proportional to the measured oxygen and combustibles concentrations. The oxygen output also contains HART communication.
2. Single FOUNDATION fieldbus output.

The power supply can accept voltages of 100 to 240 VAC and 50 to 60 Hz. The electronics accepts millivolt signals generated by the sensors and produces the outputs to be used by remotely connected devices. Refer to Section 3, Configuration and Startup for specific instructions upon initial power up.

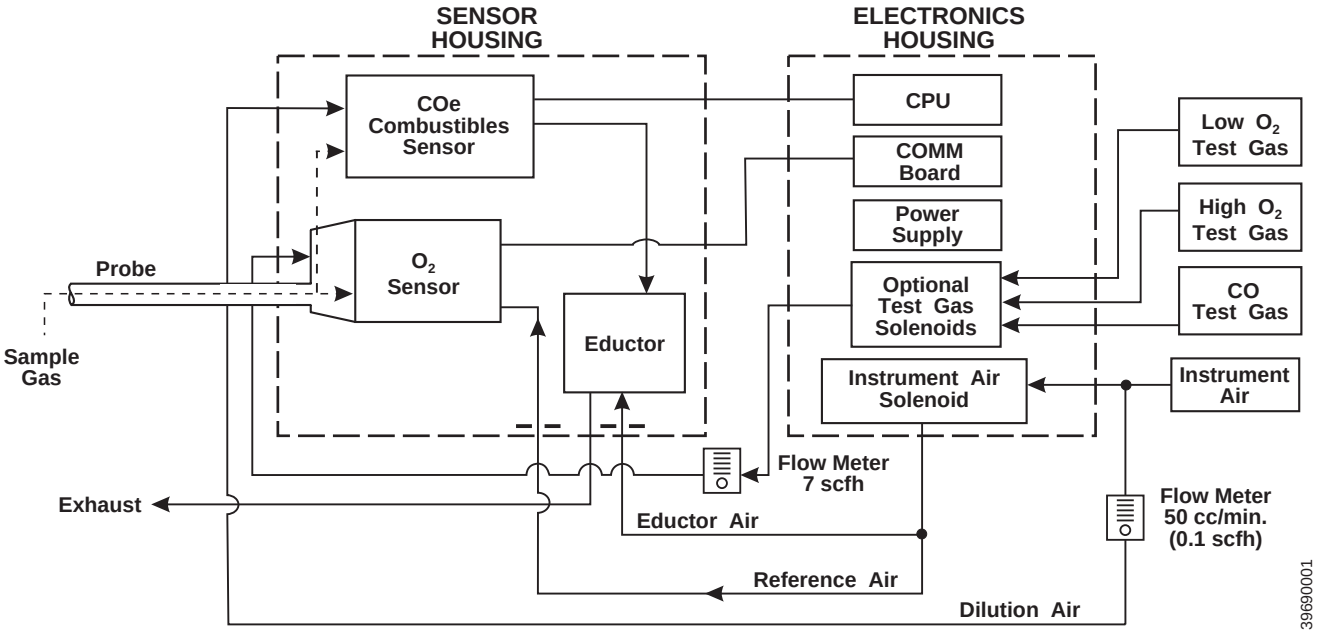
System Features

1. The O_2 cell output voltage and sensitivity increase as the oxygen concentration decreases.
2. HART or FOUNDATION fieldbus communication is standard. To use this capability, you must have either:
   a. Model 375 Field Communicator.
   b. AMS software for the PC.
3. Oxygen cell and heater/thermocouple assembly are field replaceable.
4. Electronics are automatically configured for line voltages from 100 to 240 VAC.
5. An operator can calibrate and diagnostically troubleshoot the Hazardous Area OCX 8800 in one of two ways:
   a. LOI. The LOI is mounted to the end of the electronics module and allows local communications with the electronics. Refer to Section 4, Using the LOI, for more information.
   b. HART or FOUNDATION fieldbus interface. The Hazardous Area OCX 8800's output line transmits a digital signal with the detected oxygen or combustible levels encoded in a digital format. This information can be accessed through the following:
      - Model 375 Field Communicator - The handheld field communicator requires Device Description (DD) software specific to the Hazardous Area OCX 8800. The DD software will be supplied with many Model 375 units, but can also be programmed into existing units at most Emerson Process Management service offices. Refer to Section 6, Field Communicator, for additional information.
      - Personal Computer (PC) - The use of a personal computer requires AMS software available from Emerson Process Management.
      - Selected Distributed Control Systems - The use of distributed control systems requires input/output (I/O) hardware and AMS software which permit HART or FOUNDATION fieldbus communications.
6. When the transmitter is configured without the LOI an operator must calibrate and diagnostically troubleshoot the Hazardous Area OCX 8800 using the HART or FOUNDATION fieldbus Interface.
7. Optional Blowback System. The blowback system periodically blows instrument air back through the sample line filter and out the sample tube. This clears out particulate and keeps the sample line filter from clogging.

System Operation

Figure 1-2 shows the relationship between the components of the Hazardous Area OCX 8800. The sensors and the electronics are contained in separate housings. The sensor housing and probe mounts to a duct or process wall so that the probe protrudes into the flue gas stream. An air powered eductor continuously pulls samples of the process flue gas through the probe to a chamber in front of the sensor housing where the sample passes the O_2 sensor and continues on to the COe sensor. Dilution air is provided to the COe sensor and reference air to the O_2 sensor. After the gas sample flows past the O_2 sensor and through the COe sensor, it is drawn through the eductor where it mixes with the eductor air and exits through exhaust back into the system. The electronics housing contains the CPU and communication boards which convert the sensor inputs into digital output signals. The CPU can also initiate and perform calibrations. Three test gasses and instrument air can be turned on and off by solenoids. Test gas flow to the sensors is regulated by a flow meter between the electronics and sensor housings. Instrument air is separated into eductor air, reference air, and dilution air. The instrument air solenoid does not allow air flow until the heaters are up to temperature. This minimizes the amount of sampled process flue gas being pulled into cold sensors causing condensation.

Figure 1-2. System Operation Diagram



Handling the Hazardous Area OCX 8800

⚠WARNING

It is important that printed circuit boards and integrated circuits are handled only when adequate antistatic precautions have been taken to prevent possible equipment damage.

The Hazardous Area OCX 8800 is designed for industrial application. Treat each component of the system with care to avoid physical damage. The probe may contain components made from ceramics, which are susceptible to shock when mishandled.

System Considerations

Prior to installing your Hazardous Area OCX 8800, make sure you have all the components necessary to make the system installation. Ensure all the components are properly integrated to make the system functional.

After verifying that you have all the components, select mounting locations and determine how each component will be placed in terms of available line voltage, ambient temperatures, environmental considerations, convenience, and serviceability. Figure 1-3 shows a typical system wiring for a system with integral electronics. Figure 1-4 shows a typical system wiring for a system with remote electronics. Simplified installations for the Hazardous Area OCX 8800 are shown in Figure 1-5 and Figure 1-6. Figure 1-7 shows the dimensions for the optional sample tube support. Figure 1-8 shows the dimensions for the optional in-situ filters. Figure 1-9 shows the optional panel mounted blowback.

A source of instrument air is required at the Hazardous Area OCX 8800 for reference air, dilution air, and eductor air. Since the OCX 8800 is equipped with an in-place calibration feature, provision should be made for connecting test gas tanks to the OCX 8800 when it is to be calibrated.

NOTE
The electronics module is designed to meet Type 4X and IP66 and the electronic components are rated to temperatures up to 185°F (85°C).

Retain packaging in which the unit arrived from the factory in case any components are to be shipped to another site. This packaging has been designed to protect the product.

Figure 1-3. Communication Connections and AMS Application - Hazardous Area OCX 8800 with Integral Electronics

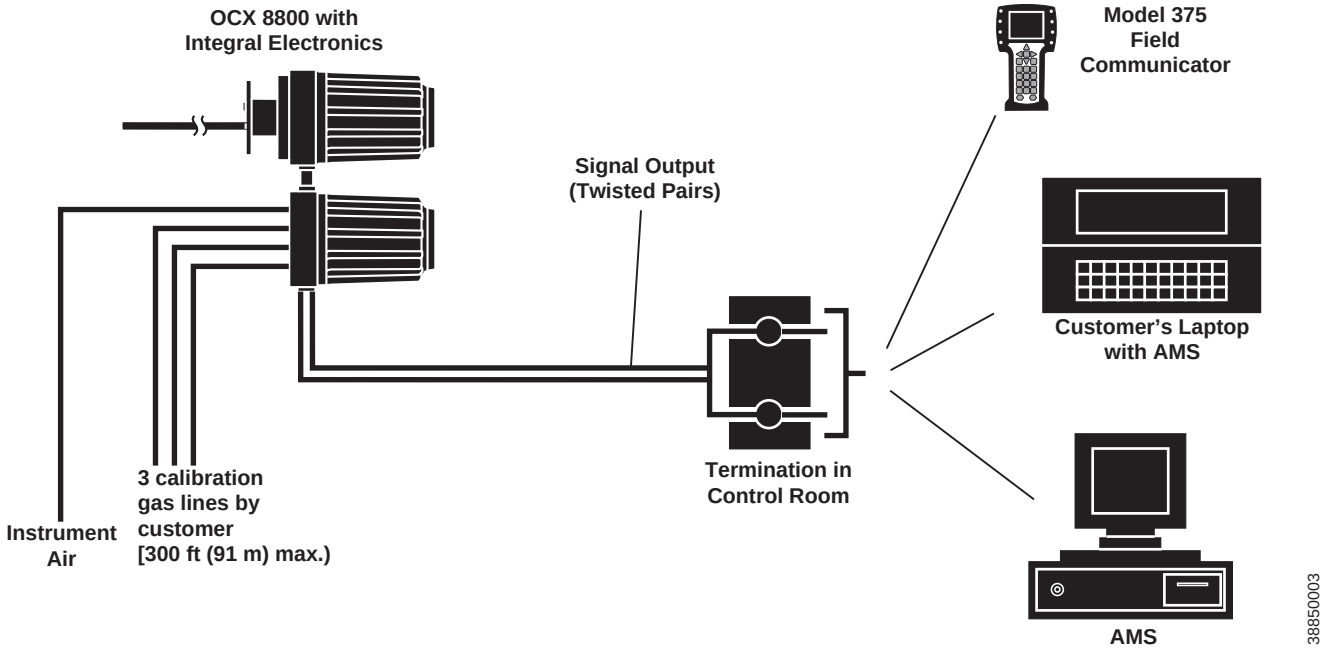


Figure 1-4. Communication Connections and AMS Application - Hazardous Area OCX 8800 with Remote Electronics

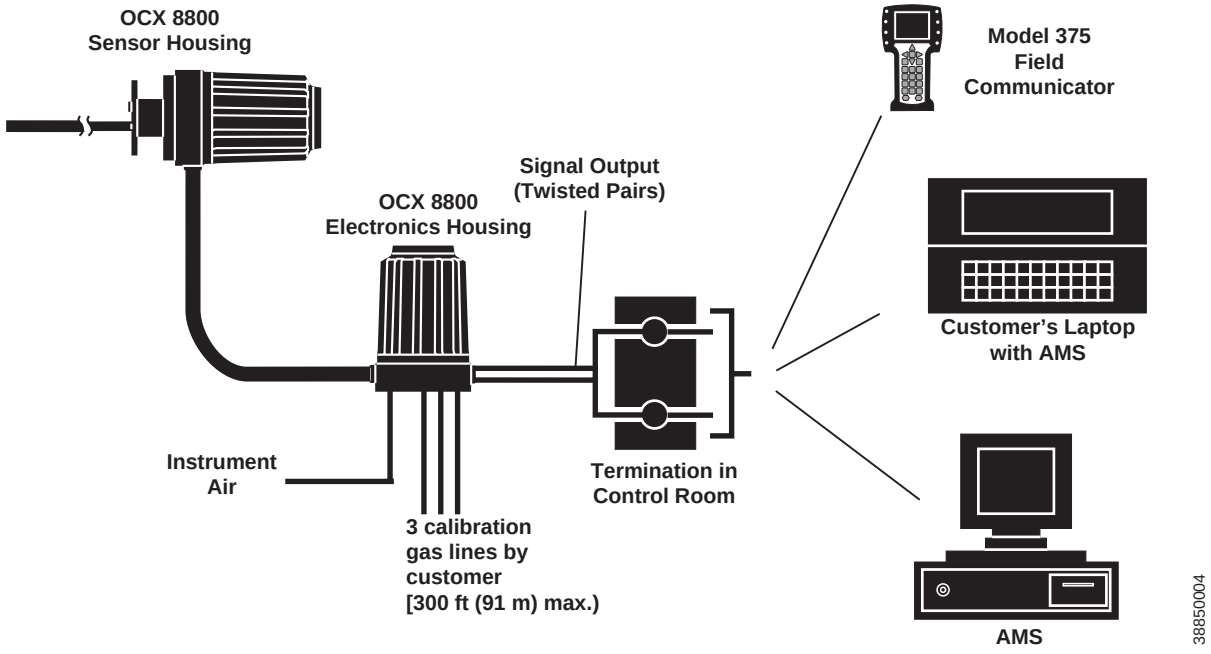


Figure 1-5. Typical System Installation - Integral Electronics

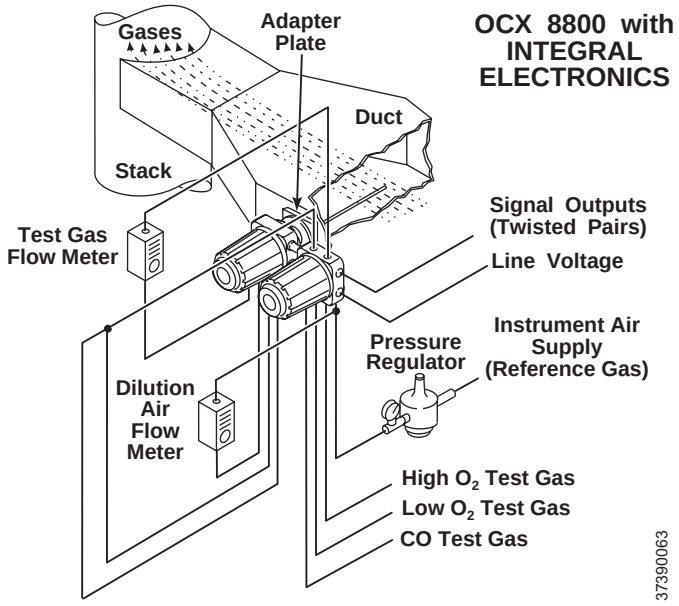


Figure 1-6. Typical System Installation - Remote Electronics

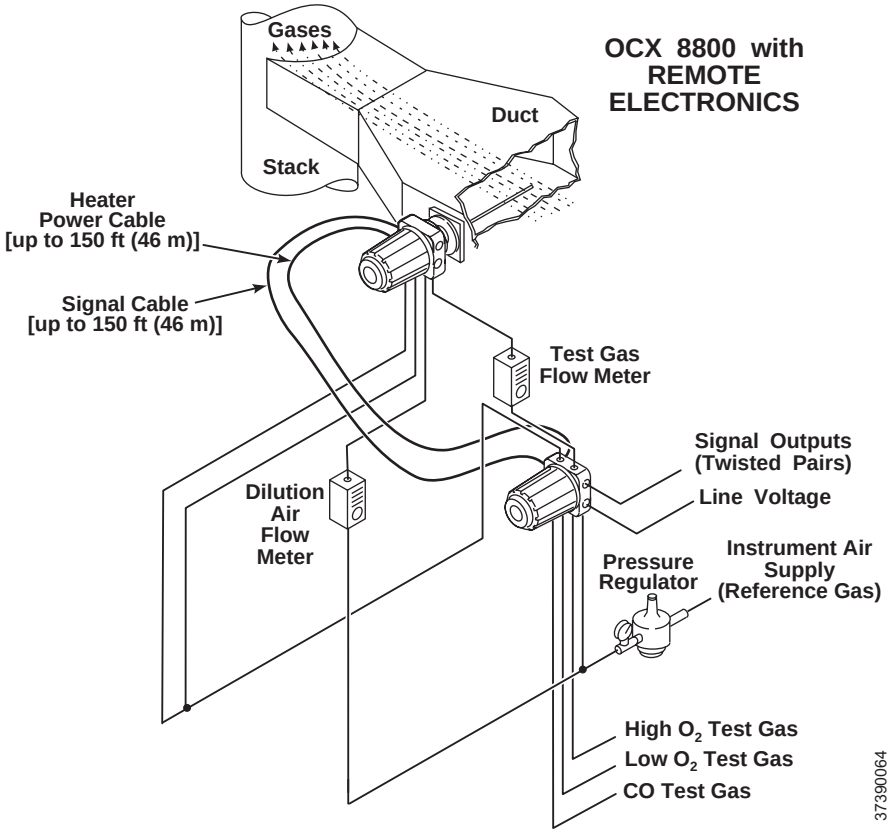


Figure 1-7. Optional Sample Tube Support

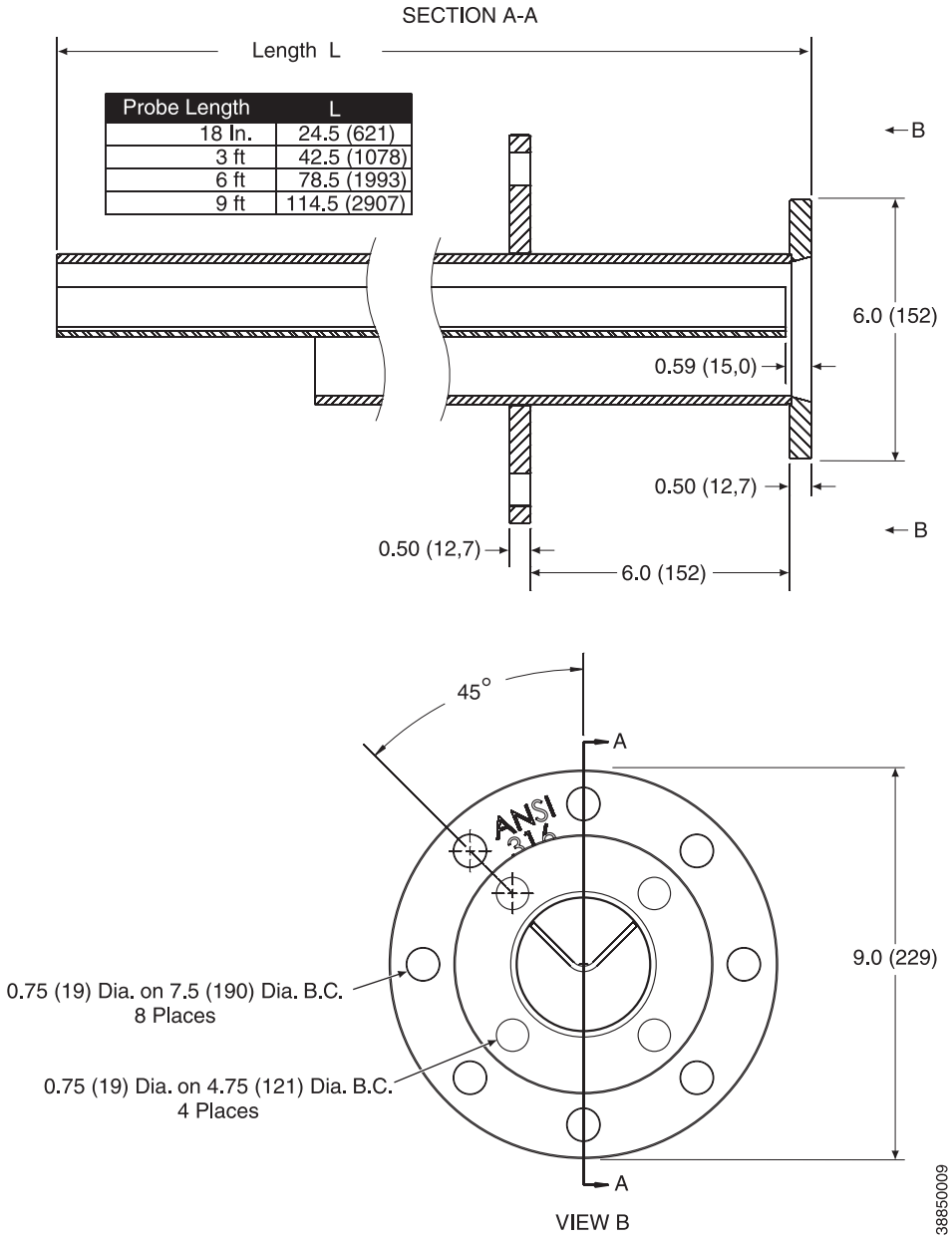


Figure 1-8. Optional In-Situ Filters

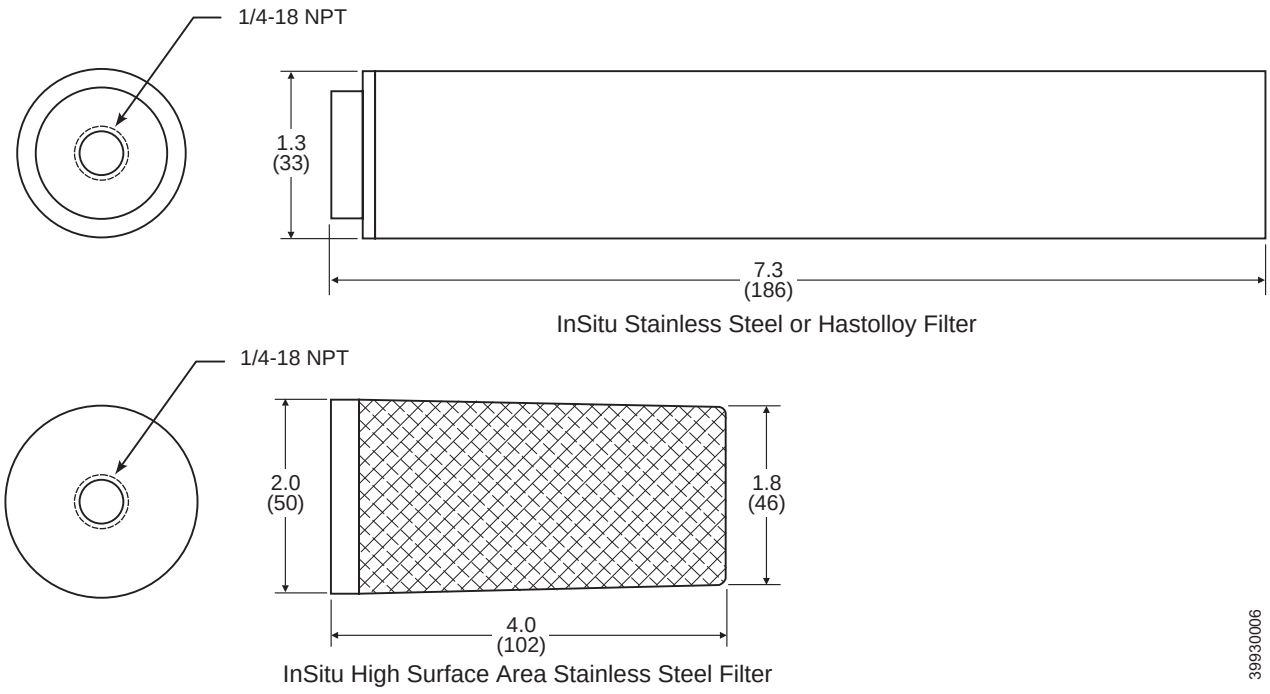
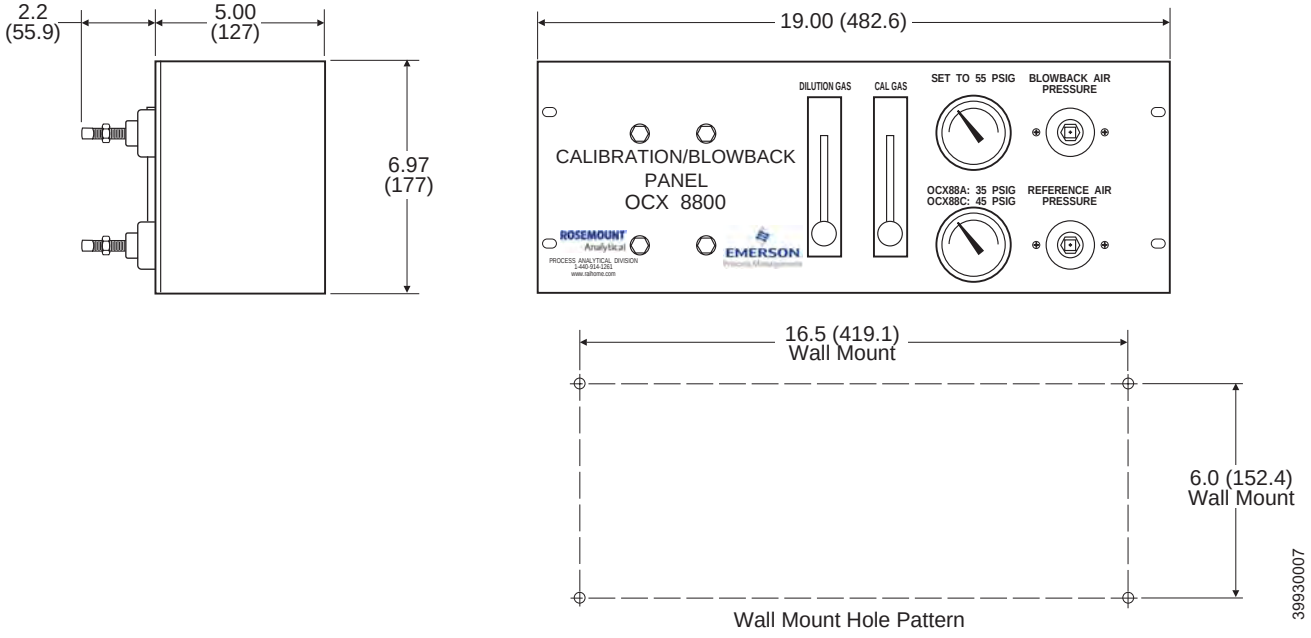


Figure 1-9. Optional Panel Mounted Blowback and Calibration/Reference Air Set (19” Rack or Wall Mount)



SPECIFICATIONS

Specifications	
Net O_2 Range	0-1% to 0-40% O_2, fully field selectable
Combustibles	0-1000 ppm to 0-5%, fully field selectable
Accuracy	
Oxygen	± 0.75% of reading or 0.05% O_2 (whichever is greater)
Combustibles	± 2% range
System Response to Test Gas	
Oxygen	10 sec T90
Combustibles	25 sec T90
Temperature Limits	
Process	32° to 2600°F (0° to 1427°C)
Sensors Housing	-40° to 212°F (-40° to 100°C), ambient
Electronics Housing	-40° to 149°F (-40° to 65°C), ambient -40° to 185°F (-40° to 85°C), internal - operating temperature of electronics inside instrument housing, as read by HART or FOUNDATION fieldbus
Local Operator Interface	-40° to 158°F (-40° to 70°C), ambient [At temperatures above 158°F (70°C) inside instrument housing, the infrared keypad will cease to function, but the Hazardous Area OCX 8800 will continue to operate properly.]
Nominal and Approximate Shipping Weights	
18 in. (457 mm) probe package	54 lbs (20 kg)
3 ft (0.91 m) probe package	55 lbs (20.5 kg)
6 ft (1.83 m) probe package	57 lbs (21 kg)
9 ft (2.74 m) probe package	59 lbs (22 kg)
Housings Mounting - Integral Electronics	Flange
Mounting and Mounting Positions - Remote Electronics	
Sensors Housing	Flange
Electronics Housing	Wall/Pipe
Materials	
Probes	316L stainless steel - 1300°F (704°C) Inconel 600 - 1832°F (1000°C) Ceramic - 2600°F (1427°C)
Enclosures	Low-copper aluminum
Calibration	Semi-automatic or automatic
Calibration Gas Mixtures Recommended (Ref. test gas bottles kit #1A99119G04)	0.4% O_2, Balance N_2 8% O_2, Balance N_2 1000 ppm CO, Balance Air
Calibration Gas Flow	7 scfh (3.3 l/m), regulated to 20 to 30 psi (138 to 207 kPa)
Reference Air	2 scfh (1 l/m), clean, dry instrument-quality air (20.95% O_2), regulated to 45 psi (310 kPa)
Eductor Air	5 scfh (2.5 l/m), clean, dry, instrument-quality air 20.95% O_2), regulated to 45 psi (310 kPa)
Dilution Air	0.1 scfh (0.05 l/m), clean, dry, instrument-quality air (20.95% O_2) regulated to 45 psi (310 kPa)

Table continued on next page

Specifications	
Blowback Air (optional)	Clean, dry, instrument-quality air (20.95% O_2), regulated to 55 psi (379 kPa)
Sensors Housing	Type 4X, IP66 with fitting and pipe on reference exhaust port to clean, dry atmosphere, two 3/4-14 NPT conduit ports
Electronics Housing	Type 4X, IP66 with fitting and pipe on reference exhaust port to clean, dry atmosphere, two 3/4-14 NPT conduit ports
Certifications	CE 0344 Ex II 2 G KEMA 04 ATEX 2308 Ex d IIB+H2 T3 IP66 SP C US 2005.1602514 CLASS 1, ZONE 1 Ex d IIB+H2 T3 AEx D IIB+H2 T3 TYPE 4X / IP66 FM APPROVED CLASS 1, ZONE 1 AEx D IIB+H2 T3 TYPE 4 / IP66 CE 0344 Ex II 2 G KEMA 04 ATEX 2308 Ex d IIB+H2 T6 IP66 SP C US 2005.1602514 CLASS 1, ZONE 1 Ex d IIB+H2 T6 AEx D IIB+H2 T6 TYPE 4X / IP66 FM APPROVED CLASS 1, ZONE 1 AEx D IIB+H2 T3 TYPE 4 / IP66
Electrical Noise	EN 61326-1, Class A
Line Voltage	Universal 100 to 240 VAC ±10%, 50 to 60 Hz, no switches or jumpers required, 3/4-14 NPT conduit port
Pollution Degree	2
Over Voltage Category	II
Relative Humidity	5 to 95% (non-condensing)
Isolated Output	
Oxygen	4-20 mAdc, 950 ohm maximum, with HART or FOUNDATION fieldbus capability only
Combustibles	4-20 mAdc, 950 ohm maximum (not present with FOUNDATION fieldbus)
Alarm	Alarm output relay - dry contact, form C, 30mA, 30VDC capacity
Power Consumption	750 W maximum

NOTE
All static performance characteristics are with operating variables constant. Specifications subject to change without notice.

Table 1-1. Product Matrix - Hazardous Area OCX 8800

OCX88C	O_2/Combustibles Transmitter - Flameproof

Code	Probe Length and Material	
00	No Probe or Exhaust Tube	
11	18 in. (457 mm) 316 SST	up to 1300°F (704°C)
12	3 ft (0.91 m) 316 SST	up to 1300°F (704°C)
13	6 ft (1.83 m) 316 SST	up to 1300°F (704°C)
14	9 ft (2.7 m) 316 SST	up to 1300°F (704°C)
21	18 in. (457 mm) Inconel 600	up to 1832°F (1000°C)
22	3 ft (0.91 m) Inconel 600	up to 1832°F (1000°C)
23	6 ft (1.83 m) Inconel 600	up to 1832°F (1000°C)
24	9 ft (2.7 m) Inconel 600	up to 1832°F (1000°C)
31	18 in. (457 mm) Ceramic	up to 2600°F (1427°C)
32	3 ft (0.91 m) Ceramic	up to 2600°F (1427°C)

Code	Probe Mounting Assembly
10	(ANSI 2 in. 150 lb) 6" dia. flange, 4.75" BC with 4 x 0.75" dia. holes - Standard O2 Cell
11	(ANSI 2 in. 150 lb) 6" dia. flange, 4.75" BC with 4 x 0.75" dia. holes - High Sulfur O2 Cell
20	(DIN) 185 mm dia. flange, 145 mm BC with 4 x 18 mm dia. holes - Standard O2 Cell
21	(DIN) 185 mm dia. flange, 145 mm BC with 4 x 18 mm dia. holes - High Sulfur O2 Cell

Code	Mounting Hardware - Stack Side
0	No Adapter Plate (“0” must be chosen under “Mounting Adapter - Probe Side” below)
1	New Installation - Square weld plate with studs
2	Model 218/240 Mounting Plate (with Model 218/240 Shield Removed)
3	Existing Model 218/240 Support Shield
4	Competitor’s Mount (1)
5	Model 132 Adapter Plate

Code	Mounting Hardware - Probe Side
0	No Adapter Plate
1	Probe Only (ANSI)
4	Probe Only (DIN)

Code	Electronics Housing - NEMA 4X, IP66 HART Communications
H1	HART Communications - Basic Unit
H2	HART Communications - Local Operator Interface
H3	HART Communications - Calibration Solenoids
H4	HART Communications - Local Operator Interface and Calibration Solenoids
F1	Fieldbus Communications - Basic Unit
F2	Fieldbus Communications - Local Operator Interface
F3	Fieldbus Communications - Calibration Solenoids
F4	Fieldbus Communications - Local Operator Interface and Calibration Solenoids

Code	Electronics Mounting
01	Integral to Sensor Housing Electronics
02	Split Architecture with no cable

OCX88C	11	10	1	1	H3	01			Example

Cont'd

Code	In-Situ Filter
0	None
2	High Surface Area Stainless Steel
3	Hastelloy

Code	Accessories
0	None
2	Cal. Gas/Flow Rotometers & Ref. Gas Set
3	Cal. Gas/Flow Rotometers & Ref. Gas Set w/ Blowback
4	Cal. Gas/Flow Rotometers & Ref. Gas Set w/ Blowback - Panel Mounted

OCX88C	**11**	**10**	**1**	**1**	**H3**	**06**	**0**	**0**	**Example**

NOTES:
(1) Provide details of the existing mounting plate as follows:

Plate with studs	Bolt circle diameter, number, and arrangement of studs, stud thread, stud height above mounting plate.
Plate without studs	Bolt circle diameter, number, and arrangement of holes, thread, depth of stud mounting plate with accessories.

Table 1-2. Accessories

PART NUMBER	DESCRIPTION
1A99119H01	Oxygen test gas bottle; 0.4% O_2, balance N_2
1A99119H02	Oxygen test gas bottle; 8.0% O_2, balance N_2
1A 99119H07	CO test gas bottle; 1000 ppm CO, balance air
1A99120H02	Regulator for Oxygen (may need 2)
1A99120H03	Regulator for CO test gas
1A99119G06	Wall mount bracket for test gas bottles
1A99119G05	Test gas regulators kit
1A99119G04	Test gas bottles kit
1A99292H01	Moore Industries SPA for Low O_2 Alarm, High COe Alarm, Calibration Status, and Unit Fail
4851B40G02	Wall or Pipe Mounting Kit
1A99784H02	375 Field Communicator with 12 Megabyte buffer, model no. 375HR1EKLU
6A00171G01	Power line filter kit
6A00288G01	Sample Tube Support, 18 in. (457 mm)
6A00288G02	Sample Tube Support, 3 Ft. (0.91 m)
6A00288G02	Sample Tube Support, 6 Ft. (1.83 m)
6A00288G04	Sample Tube Support, 9 Ft. (2.7 m)
6P00162H01	Flange Insulator

Section 2 Installation

Mechanical Installation . . . . . page 2-2
Electrical Installation . . . . . page 2-7
Pneumatic Installation . . . . . page 2-13
Initial Startup . . . . . page 2-24

⚠WARNING

Before installing this equipment, read the "Safety instructions for the wiring and installation of this apparatus" in Appendix A: Safety Data. Failure to follow the safety instructions could result in serious injury or death.

⚠WARNING

The OCX88A can be installed in general purpose areas only. Do not install the OCX88A in hazardous areas.

⚠WARNING

To maintain explosion-proof protection of the OCX 88C in hazardous areas, all cable entry devices and blanking elements for unused apertures must be certified flameproof, suitable for the conditions of use and properly installed.

⚠WARNING

To maintain explosion-proof protection of the OCX88C in hazardous areas, the sensor housing must not be mounted to any surface or flange that exceeds 200ºC (392ºF).

⚠WARNING

To maintain explosion-proof protection of the OCX 88C in hazardous areas, the sample entering the sensor housing must not exceed 200ºC (392ºF).

MECHANICAL INSTALLATION

Selecting Location

1. The location of the Hazardous Area OCX 8800 in the stack or flue is most important for maximum accuracy in the oxygen analyzing process. The probe must be positioned so the gas it measures is representative of the process. Best results are normally obtained if the transmitter is positioned near the center of the duct (40-60% insertion). Longer ducts may require several transmitters since the oxygen and combustibles can vary due to stratification. A point too near the wall of the duct or the inside radius of a bend, may not provide a representative sample because of the very low flow conditions. The sensing point should be selected so the process gas temperature falls within the range of probe material used. Figure 2-1 through Figure 2-5 provide mechanical installation references. The ambient temperature inside the electronics housing must not exceed 185°F (85°C).
2. Check the flue or stack for holes and air leakage. The presence of this condition will substantially affect the accuracy of the oxygen and combustibles readings. Therefore, either make the necessary repairs or install the transmitter up stream of any leakage.
3. Ensure the area is clear of internal and external obstructions that will interfere with installation and maintenance access to the unit. Allow adequate clearance for the removal of the Hazardous Area OCX 8800.

⚠CAUTION

Do not allow the temperature of the electronics housing to exceed 185°F (85°C) or damage to the electronics may result.

⚠CAUTION

Whenever a positive stack pressure exists at the installation site, be sure to connect all pneumatic lines prior to installing the Hazardous Area OCX 8800 in the stack or ductwork. Failure to connect the pneumatic lines can allow the flow of contaminants into the Hazardous Area OCX 8800 ports.

Installation

1. Ensure all components are available to install the OCX 8800.
2. The Hazardous Area OCX 8800 may be installed intact as it is received.
3. Weld or bolt adapter plate (Figure 2-3) onto the duct.
4. Use the pipe or wall mounting hardware as shown in Figure 2-4 to mount a remote electronics housing. Choose a location not to exceed the length of the electronics cable ordered.
5. Ensure the conduits drop vertically from the Hazardous Area OCX 8800 and the conduit is routed below the level of the conduit ports on the housing to form a drip loop. Drip loops minimize the possibility that moisture will damage the electronics (Figure 2-5).
6. Where a positive stack pressure exists at the installation site, connect all pneumatic lines prior to installing the Hazardous Area OCX 8800 in the stack or ductwork.

NOTE
If process temperatures will exceed 392°F (200°C), use anti-seize compound on stud threads to ease future removal of the Hazardous Area OCX 8800.

7. Insert sample and exhaust tubes through the opening in the mounting flange and bolt the unit to the flange.

⚠CAUTION

Uninsulated stacks or ducts may cause ambient temperatures in the electronics housing to exceed 185°F (85°C) and damage the electronics.

8. If insulation is removed to access the duct for Hazardous Area OCX 8800 mounting, make sure to replace insulation afterward.

Figure 2-1. Installation, Hazardous Area OCX 8800 with Integral Electronics

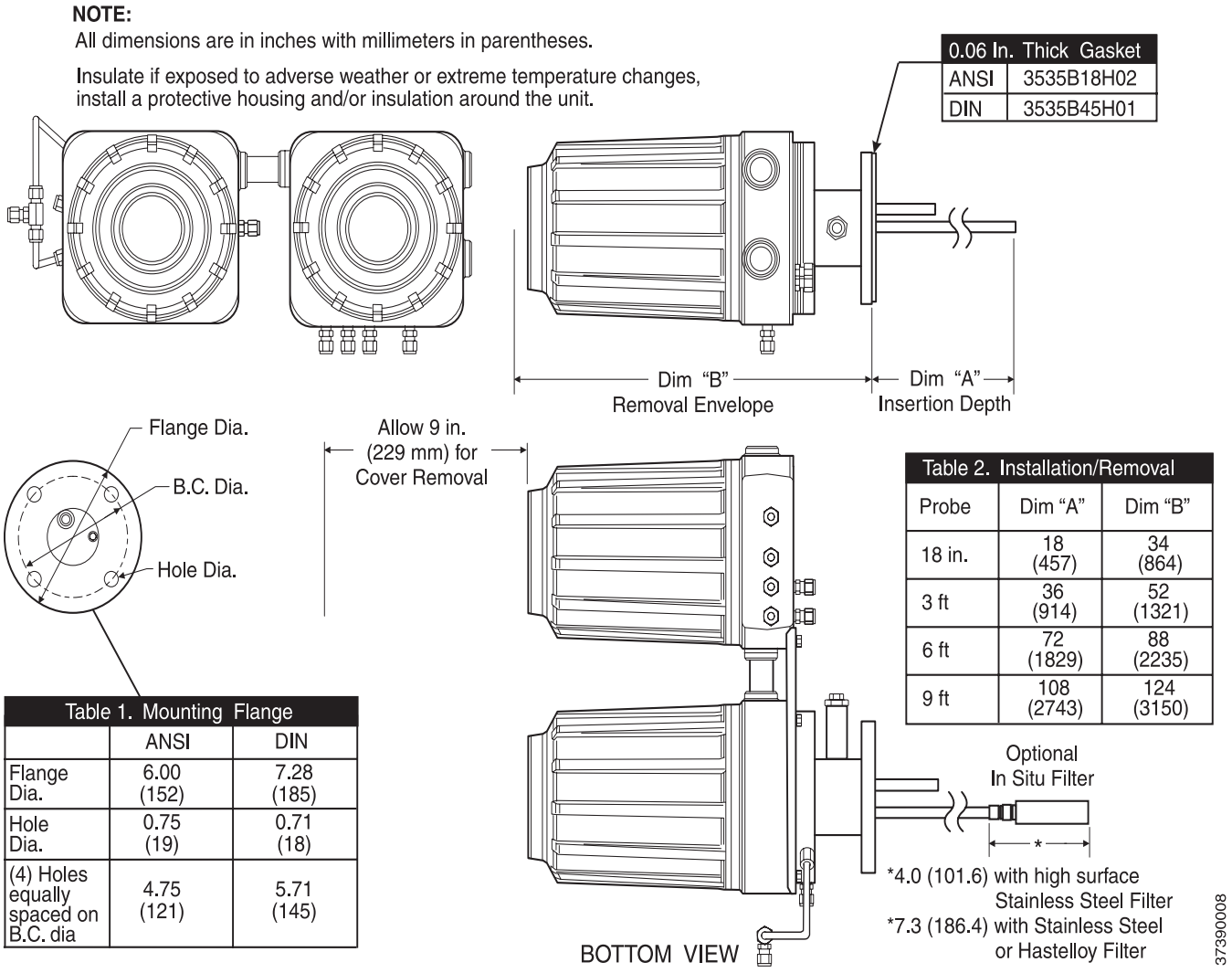


Table 1. Mounting Flange

	ANSI	DIN
Flange Dia.	6.00 (152)	7.28 (185)
Hole Dia.	0.75 (19)	0.71 (18)
(4) Holes equally spaced on B.C. dia	4.75 (121)	5.71 (145)

Table 2. Installation/Removal

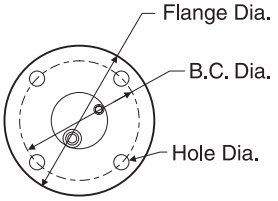
Probe	Dim "A"	Dim "B"
18 in.	18 (457)	34 (864)
3 ft	36 (914)	52 (1321)
6 ft	72 (1829)	88 (2235)
9 ft	108 (2743)	124 (3150)

Figure 2-2. Installation, Hazardous Area OCX 8800 with Remote Electronics

NOTE: Dimensions are in inches with millimeters in parentheses.

Insulate if exposed to adverse weather or extreme temperature changes, install a protective housing and/or insulation around the unit.

Table 1. Mounting Flange		
	ANSI	DIN
Flange Dia.	6.00 (152)	7.28 (185)
Hole Dia.	0.75 (19)	0.71 (18)
(4) Holes equally spaced on B.C. dia	4.75 (121)	5.71 (145)



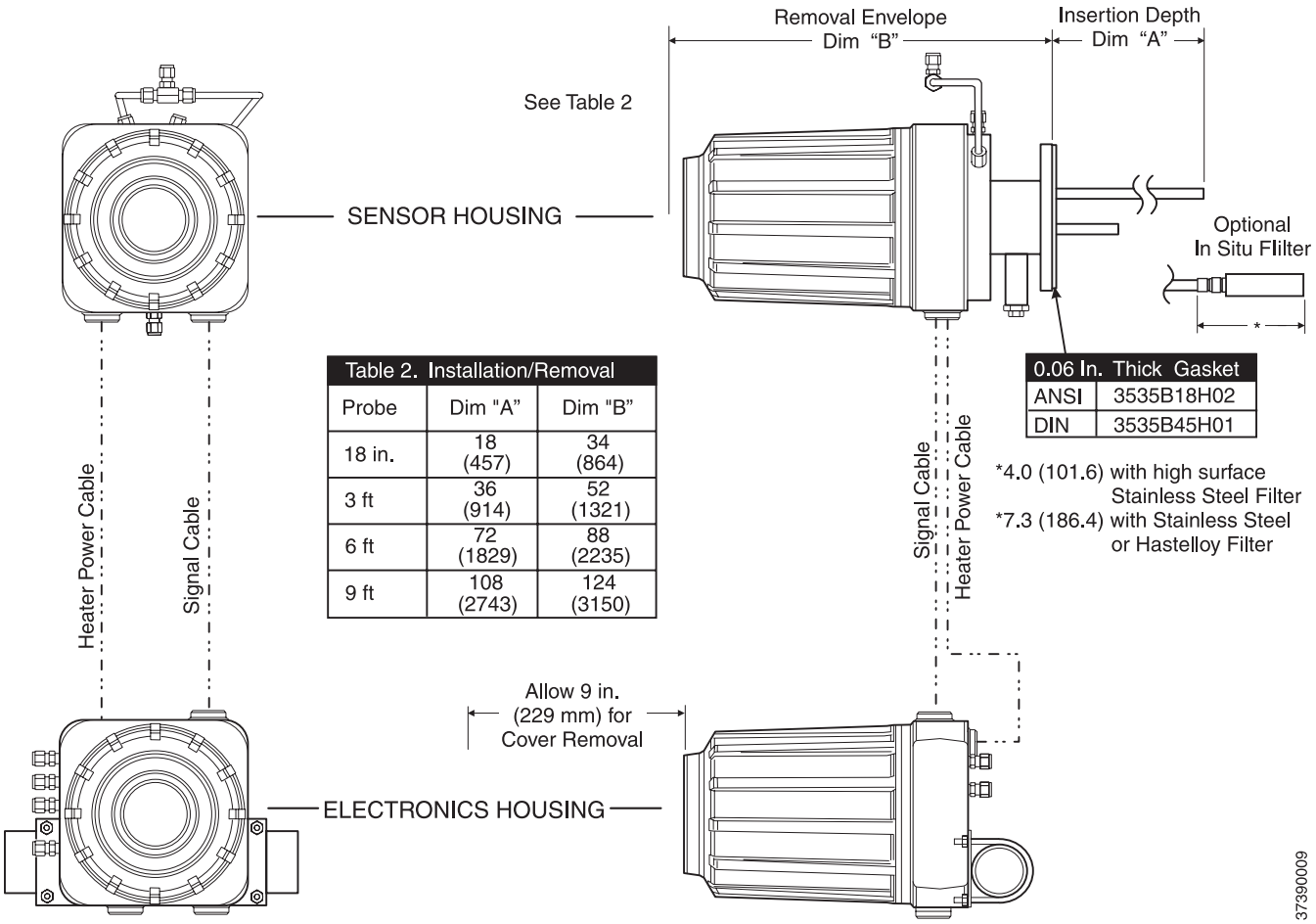


Table 2. Installation/Removal		
Probe	Dim "A"	Dim "B"
18 in.	18 (457)	34 (864)
3 ft	36 (914)	52 (1321)
6 ft	72 (1829)	88 (2235)
9 ft	108 (2743)	124 (3150)

0.06 In. Thick Gasket	
ANSI	3535B18H02
DIN	3535B45H01

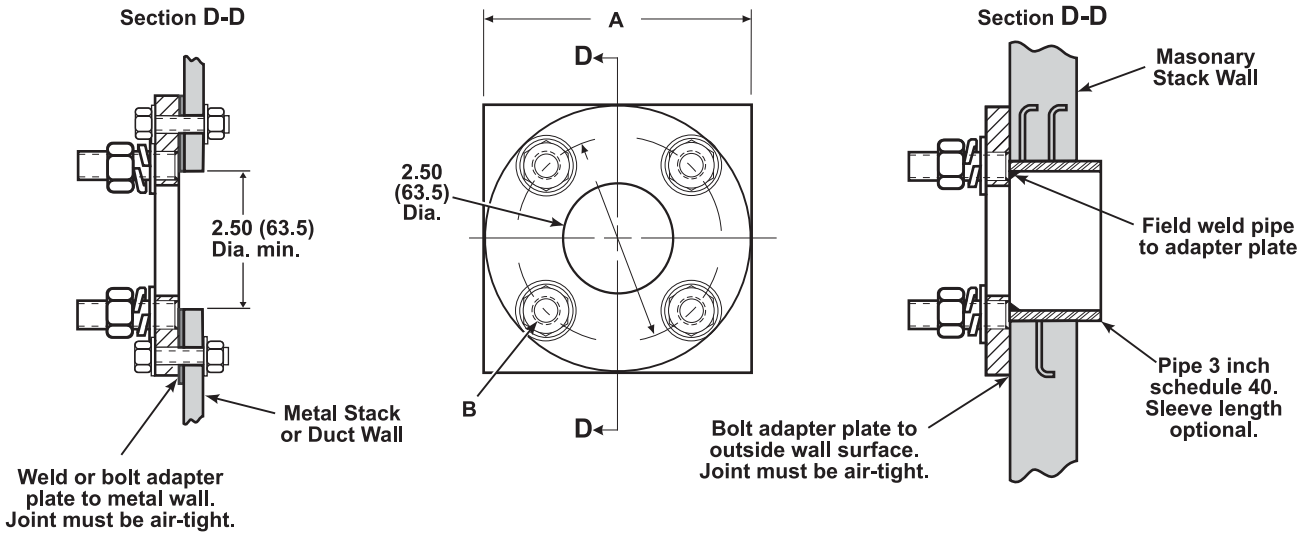
*4.0 (101.6) with high surface Stainless Steel Filter
*7.3 (186.4) with Stainless Steel or Hastelloy Filter

Figure 2-3. Adapter Plate Installation

NOTE: Dimensions are in inches with millimeters in parentheses. Only adapter plate is furnished by Emerson Process Management.

Adapter Plate Kit - Mounting Dimensions			
*Type Part Number	Plate Size "A"	Stud Size "B"	Bolt Circle Dia. "C"
ANSI (P/N 4512C34G01)	6.00 (152)	5/8 -11 UNC - 2A	4.75 (121)
DIN (P/N 4512C36G01)	7.50 (191)	(M-16 x 2.0 - 6g)	5.71 (145)

***Part numbers for adapter plates include attaching hardware.**


Section D-D
2.50 (63.5) Dia. min.
Metal Stack or Duct Wall
Weld or bolt adapter plate to metal wall. Joint must be air-tight.
A
D
2.50 (63.5) Dia.
B
D
Section D-D
Masonary Stack Wall
Field weld pipe to adapter plate
Pipe 3 inch schedule 40. Sleeve length optional.
Bolt adapter plate to outside wall surface. Joint must be air-tight.

METAL WALL STACK OR DUCT CONSTRUCTION

MASONRY WALL STACK CONSTRUCTION

37390010

Figure 2-4. Wall or Pipe Mounting of Electronics Housing

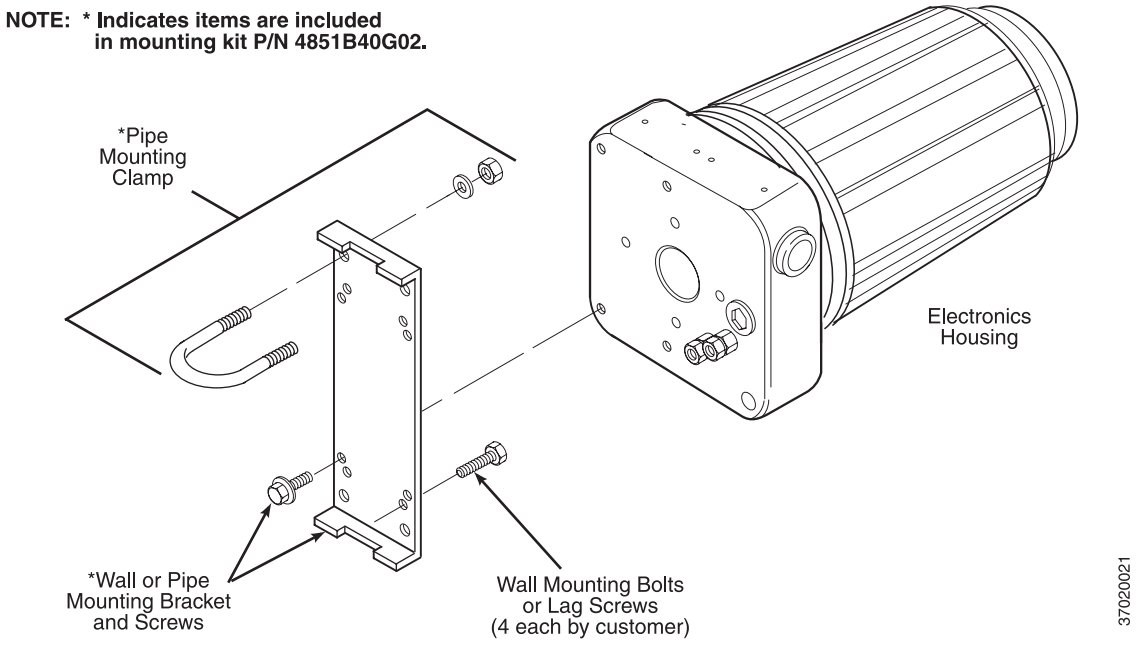
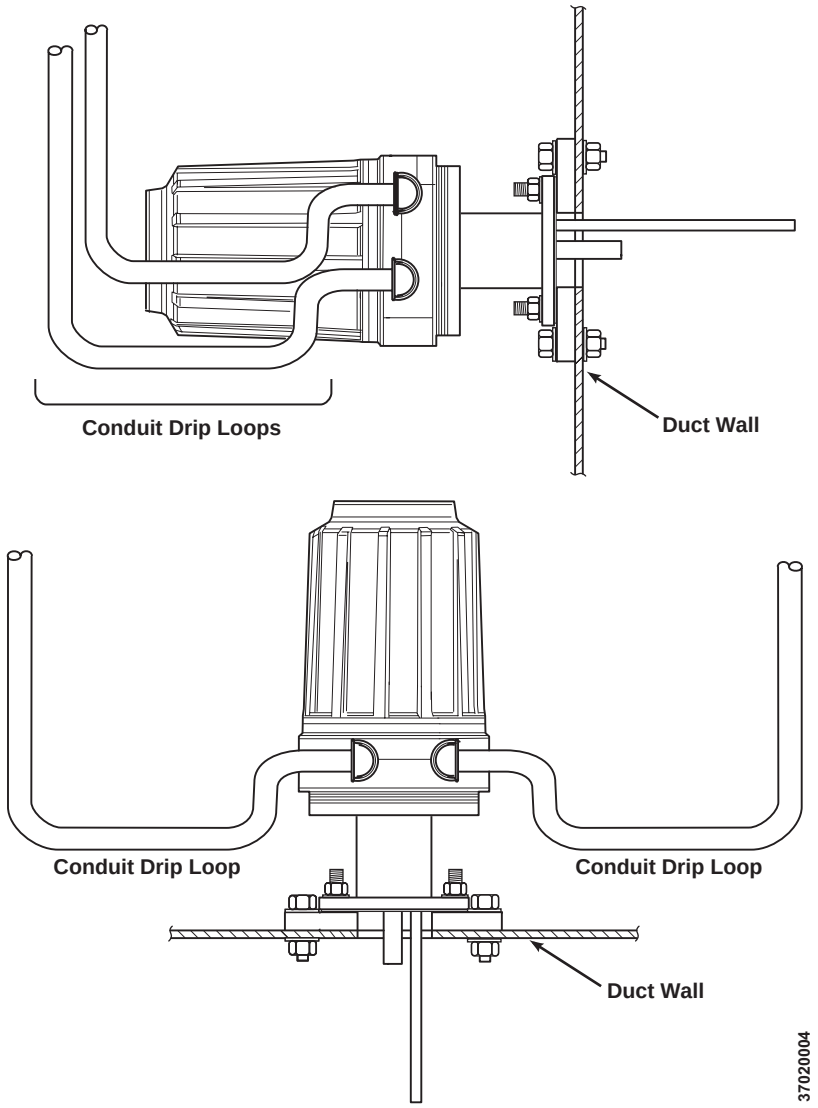

NOTE: * Indicates items are included in mounting kit P/N 4851B40G02.
*Pipe Mounting Clamp
Electronics Housing
*Wall or Pipe Mounting Bracket and Screws
Wall Mounting Bolts or Lag Screws (4 each by customer)
37020021

Figure 2-5. Installation with Drip Loops



ELECTRICAL INSTALLATION

All wiring must conform to local and national codes. For reference, factory wired solenoid power connections are shown in Figure 2-6.

⚠WARNING

Disconnect and lock out power before connecting the unit to the power supply. Failure to lock out power could result in serious injury or death.

⚠WARNING

Install all protective equipment covers and safety ground leads after installation. Failure to install covers and ground leads could result in serious injury or death.

⚠WARNING

To meet the Safety Requirements of IEC 1010 (EC requirement), and ensure safe operation of this equipment, connection to the main electrical power supply must be made through a circuit breaker (min 10 A) in close proximity and marked for this equipment which will disconnect all current-carrying conductors during a fault situation. This circuit breaker should also include a mechanically operated isolating switch. If not, then another external means of disconnecting the supply from the equipment should be located close by. Circuit breakers or switches must comply with a recognized standard such as IEC 947.

⚠WARNING

.To maintain explosion-proof protection of the OCX 8800 in hazardous areas, all cable entry devices and blanking elements for unused apertures must be certified flameproof, suitable for the conditions of use and properly installed.

⚠WARNING

To maintain explosion-proof protection of the OCX88C in hazardous areas, the sensor housing must not be mounted to any surface or flange that exceeds 200ºC (392ºF).

⚠WARNING

To maintain explosion-proof protection of the OCX88C in hazardous areas, the sample entering the sensor housing must not exceed 200ºC (392ºF).

NOTE
To maintain proper earth grounding, ensure a positive connection exists between the sensor housing, the electronics housing, and earth. The connecting ground wire must be 14 AWG minimum. Refer to Figure 2-6.

NOTE
Line voltage, signal, and relay wiring must be rated for at least 105ºC (221ºF).

Electrical Connections

Electrical connections, power and communications are made to the electronic enclosure. The connections are made through two 3/4 NPT ports in the enclosure using fittings and cables provided by the customer. Cable installation must meet NEC, IEC and/or other applicable national or local codes for Class I, Zone 1, IIB +H2 T3/T6 permanently mounted equipment.

Connect Line Voltage

The Hazardous Area OCX 8800 operates on 100 to 240 VAC line voltage at 50 to 60 Hz. The power supply requires no setup. Connect the line (L wire) to the L terminal, and the neutral (N wire) to the N terminal on the AC power input terminal block in the electronics housing. Connect the ground (G wire) to the ground stud in the electronics housing as shown in Figure 2-6.

Connect Output Signals

The Hazardous Area OCX 8800 may be provided with either two 4-20 mA signals with HART on the O2 signal or a single FOUNDATION fieldbus signal. Connect the output terminals in the electronics housing as shown in Figure 2-6. Use individual shielded twisted wire pairs. Terminate the shield at the electronics housing.

O_2 4-20 mA Signal

One 4-20 mA signal represents the O_2 value. Superimposed on the O_2 signal is the HART information accessible through a Model 375 Handheld Communicator or AMS software. The O_2 signal is at the AOUT 1 terminals.

COe 4-20 mA Signal

Another 4-20 mA signal at the AOUT 2 terminals represents the COe value.

FOUNDATION fieldbus Signal

The FOUNDATION fieldbus signal provides all output information and is accessible through a Model 375 handheld communicator.

Alarm Output Relay

Connect any customer-supplied relay input to the alarm output relay terminal. Use shielded wire and terminate the shield at the electronics housing. The alarm output relay terminal is a set of dry, no. 2, form C, contacts with 30 mA, 30 VDC capacity.

Remote Electronics Connections to Sensor Housing

Make the following connections between the remote electronics and sensor housings with the electronics cable ordered with the package (Figure 2-7). Braided cable is available in lengths up to 150 ft. (46 m).

NOTE
Interconnect wiring shown is for Rosemount Analytical supplied cables. For customer furnished interconnect wiring or cables, refer to Figure 2-8.

Signal Connections

Connect the electronics housing terminals to the corresponding terminals in the sensor housing. The twisted wire pairs are numbered on the inner plastic wrapper. Keep twisted pairs together and match the numbers and wire colors shown in Figure 2-7.

Heater Power Connections

Use the blue, white, orange black, red, and yellow stranded wires in the heater power cable to connect power to the three heaters in the sensor housing. Match the wire colors to the corresponding heater power terminal blocks in the sensor and electronics housings as shown in Figure 2-7.

Figure 2-6. Line Voltage, Earth, and 4-20 mA Connections

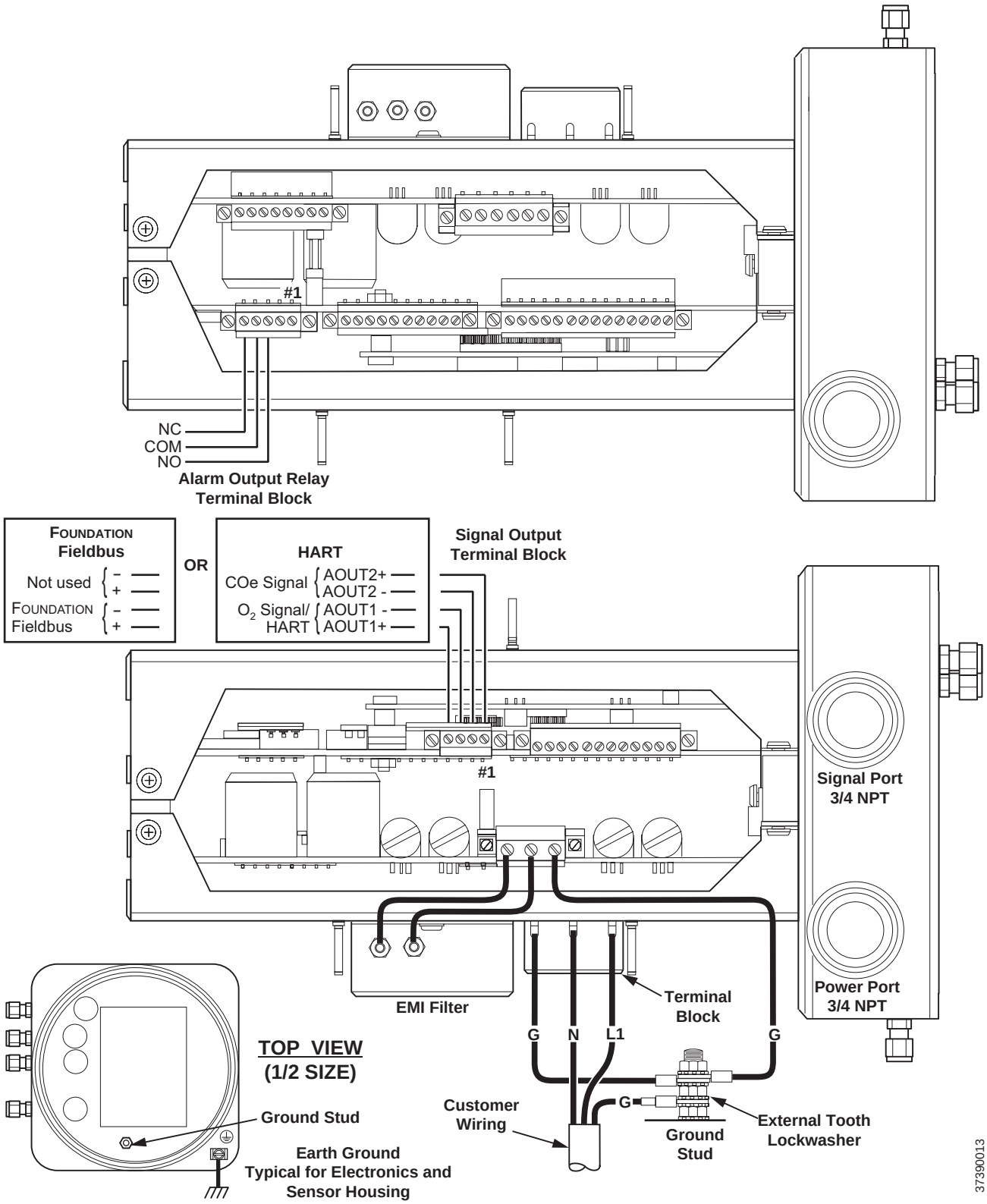


Figure 2-7. Electrical Connections Between Remote Electronics and Sensor Housing

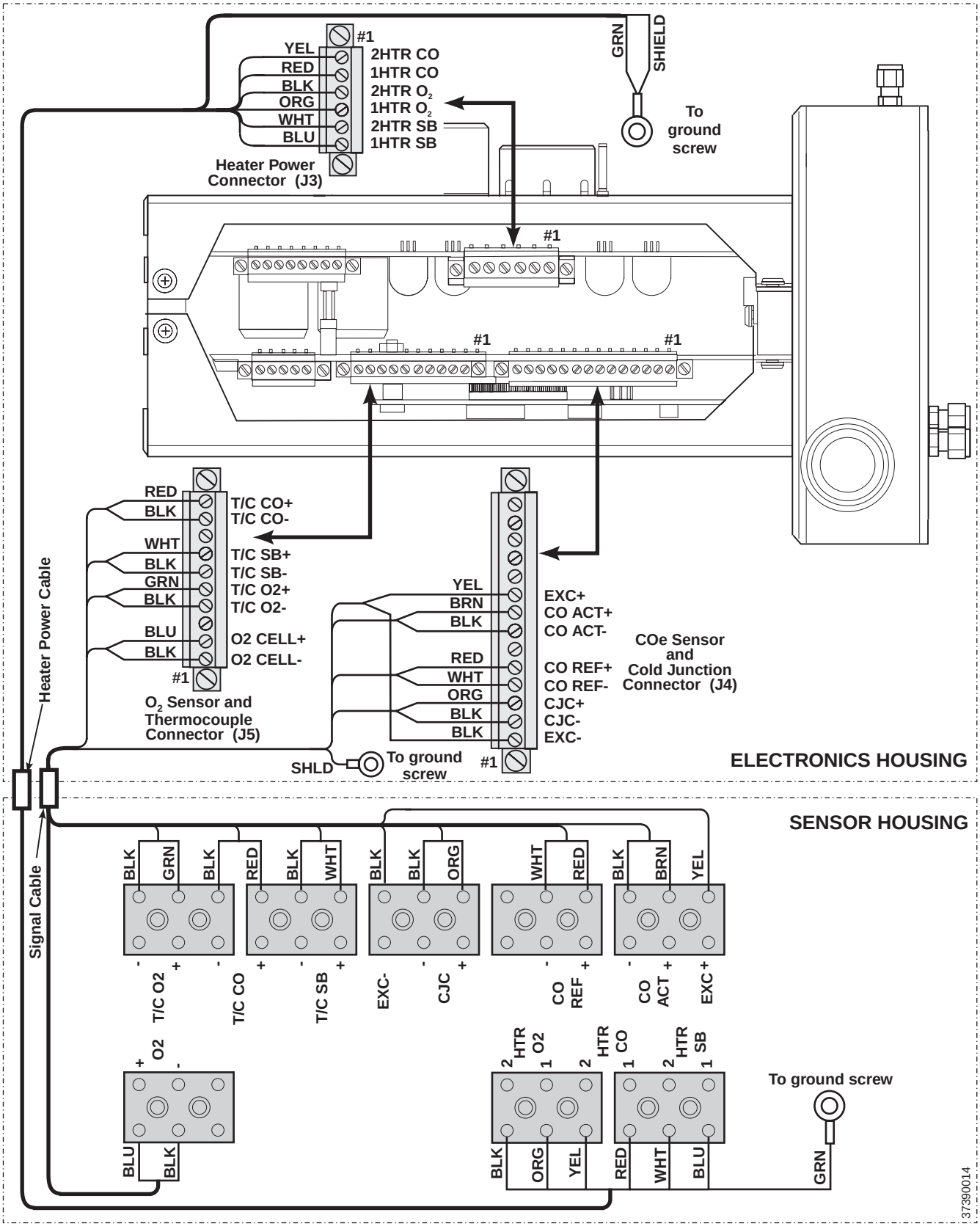
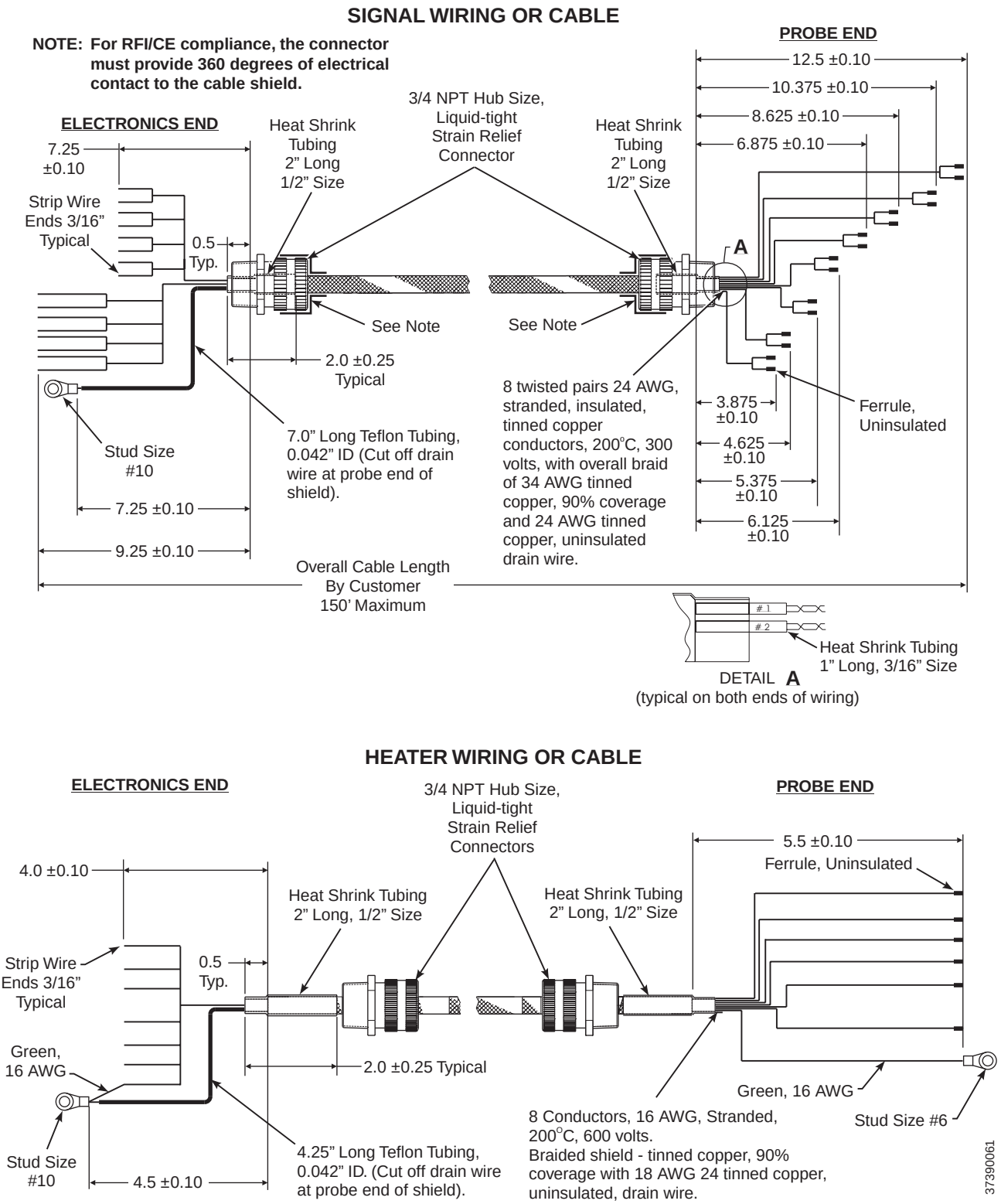


Figure 2-8. Customer-Furnished Interconnect Wiring or Cables


SIGNAL WIRING OR CABLE
NOTE: For RFI/CE compliance, the connector must provide 360 degrees of electrical contact to the cable shield.
ELECTRONICS END
PROBE END
7.25 ±0.10
Strip Wire Ends 3/16" Typical
0.5 Typ.
Heat Shrink Tubing 2" Long 1/2" Size
3/4 NPT Hub Size, Liquid-tight Strain Relief Connector
Heat Shrink Tubing 2" Long 1/2" Size
12.5 ±0.10
10.375 ±0.10
8.625 ±0.10
6.875 ±0.10
A
See Note
See Note
2.0 ±0.25 Typical
Stud Size #10
7.0" Long Teflon Tubing, 0.042" ID (Cut off drain wire at probe end of shield).
8 twisted pairs 24 AWG, stranded, insulated, tinned copper conductors, 200°C, 300 volts, with overall braid of 34 AWG tinned copper, 90% coverage and 24 AWG tinned copper, uninsulated drain wire.
3.875 ±0.10
4.625 ±0.10
5.375 ±0.10
6.125 ±0.10
Ferrule, Uninsulated
7.25 ±0.10
9.25 ±0.10
Overall Cable Length By Customer 150' Maximum
#1
#2
Heat Shrink Tubing 1" Long, 3/16" Size
DETAIL A
(typical on both ends of wiring)
HEATER WIRING OR CABLE
ELECTRONICS END
PROBE END
3/4 NPT Hub Size, Liquid-tight Strain Relief Connectors
4.0 ±0.10
Heat Shrink Tubing 2" Long, 1/2" Size
Heat Shrink Tubing 2" Long, 1/2" Size
5.5 ±0.10
Ferrule, Uninsulated
Strip Wire Ends 3/16" Typical
0.5 Typ.
Green, 16 AWG
2.0 ±0.25 Typical
Green, 16 AWG
Stud Size #6
Stud Size #10
4.5 ±0.10
4.25" Long Teflon Tubing, 0.042" ID. (Cut off drain wire at probe end of shield).
8 Conductors, 16 AWG, Stranded, 200°C, 600 volts.
Braided shield - tinned copper, 90% coverage with 18 AWG 24 tinned copper, uninsulated, drain wire.
37390061

PNEUMATIC INSTALLATION

Pneumatic system connections depend on whether reference air set, calibration solenoids, and/or blowback equipment options are equipped on your transmitter. Refer to the following paragraphs and select the option that applies to your transmitter configuration.

Reference Air Set Option (only)

When no options or only the reference air set option is equipped, use the following procedure to install the pneumatic system components.

1. Refer to Figure 2-9. Connect the reference air set (regulator/filter and pressure gage) to the instrument air inlet on the electronics housing and to the inlet side of the dilution air flow meter.
2. Connect the dilution air flow meter output to the dilution air inlet fitting on the sensor housing.
3. Install an air line between the instrument air outlet fitting on the electronics housing and the tee fitting on the sensor housing.

.

⚠CAUTION

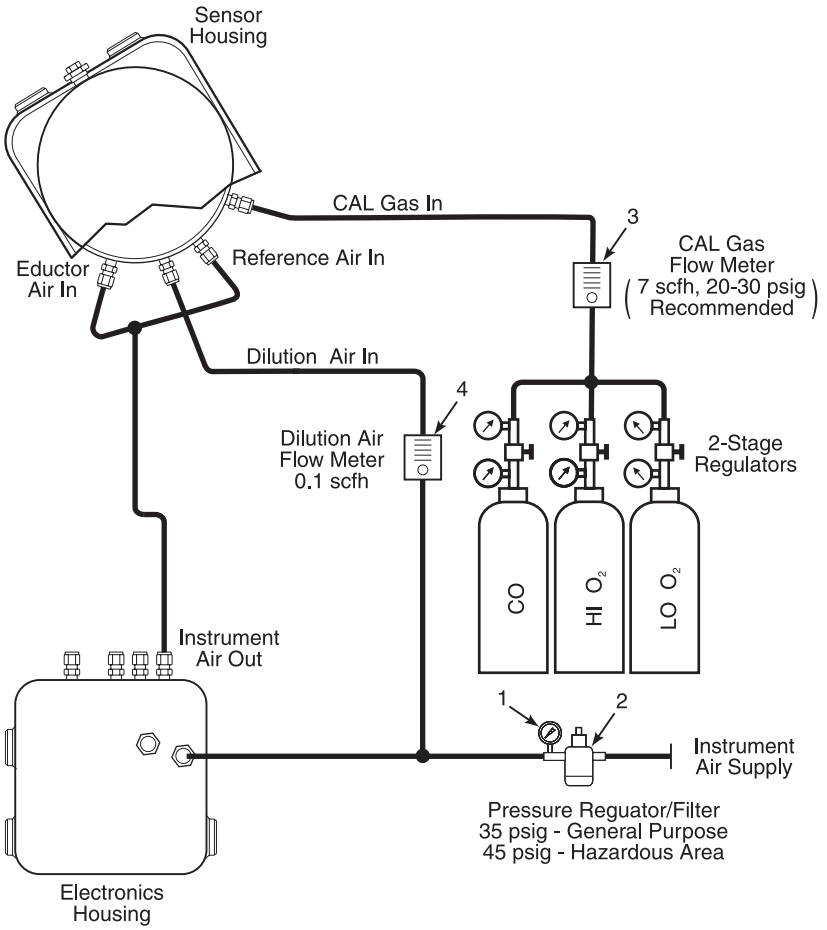
Do not use 100% nitrogen as an O_2 low gas. It is suggested that O_2 low gas be between 0.4% and 2.0% O_2. Do not use gases with hydrocarbon concentrations of more than 40 parts per million. Failure to use proper gases will result in erroneous readings.

4. One CO gas and two O_2 gases are used to calibrate the Hazardous Area OCX 8800:

   CO - 1000 ppm or up to 4%, Balance air
   O_2 low gas - 0.4% , Balance N_2
   O_2 high gas - 8%, Balance N_2

   Connect the output of the test gas sources to the inlet port of the CAL GAS flow meter. Install an air line between the flow meter outlet port and the CAL GAS inlet fitting on the sensor housing.

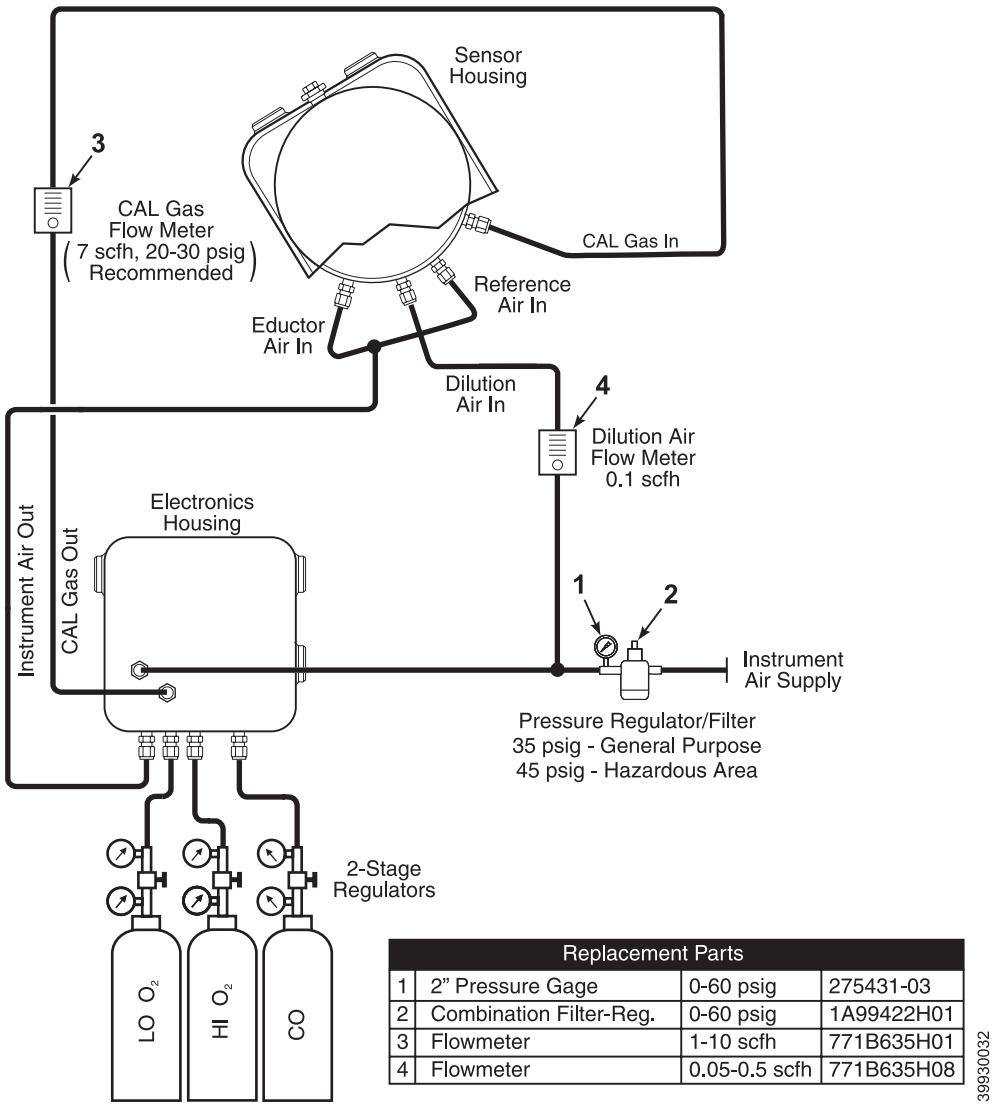
Figure 2-9. Pneumatic Installation, OCX with Reference Air Set without Autocalibration



Replacement Parts			
1	2” Pressure Gage	0-60 psig	275431-03
2	Combination Filter-Reg.	0-60 psig	1A99422H01
3	Flowmeter	1-10 scfh	771B635H01
4	Flowmeter	0.05-0.5 scfh	771B635H08

39930031

Figure 2-10. Pneumatic Installation, OCX with Reference Air Set, Solenoids and Autocalibration, without COe Zero Function



Replacement Parts			
1	2” Pressure Gage	0-60 psig	275431-03
2	Combination Filter-Reg.	0-60 psig	1A99422H01
3	Flowmeter	1-10 scfh	771B635H01
4	Flowmeter	0.05-0.5 scfh	771B635H08

Reference Air Set and Solenoids Option without COe Zero Function

When the reference air set and test gas solenoids are included with your Hazardous Area OCX 8800, use the following procedure to install the pneumatic system components.

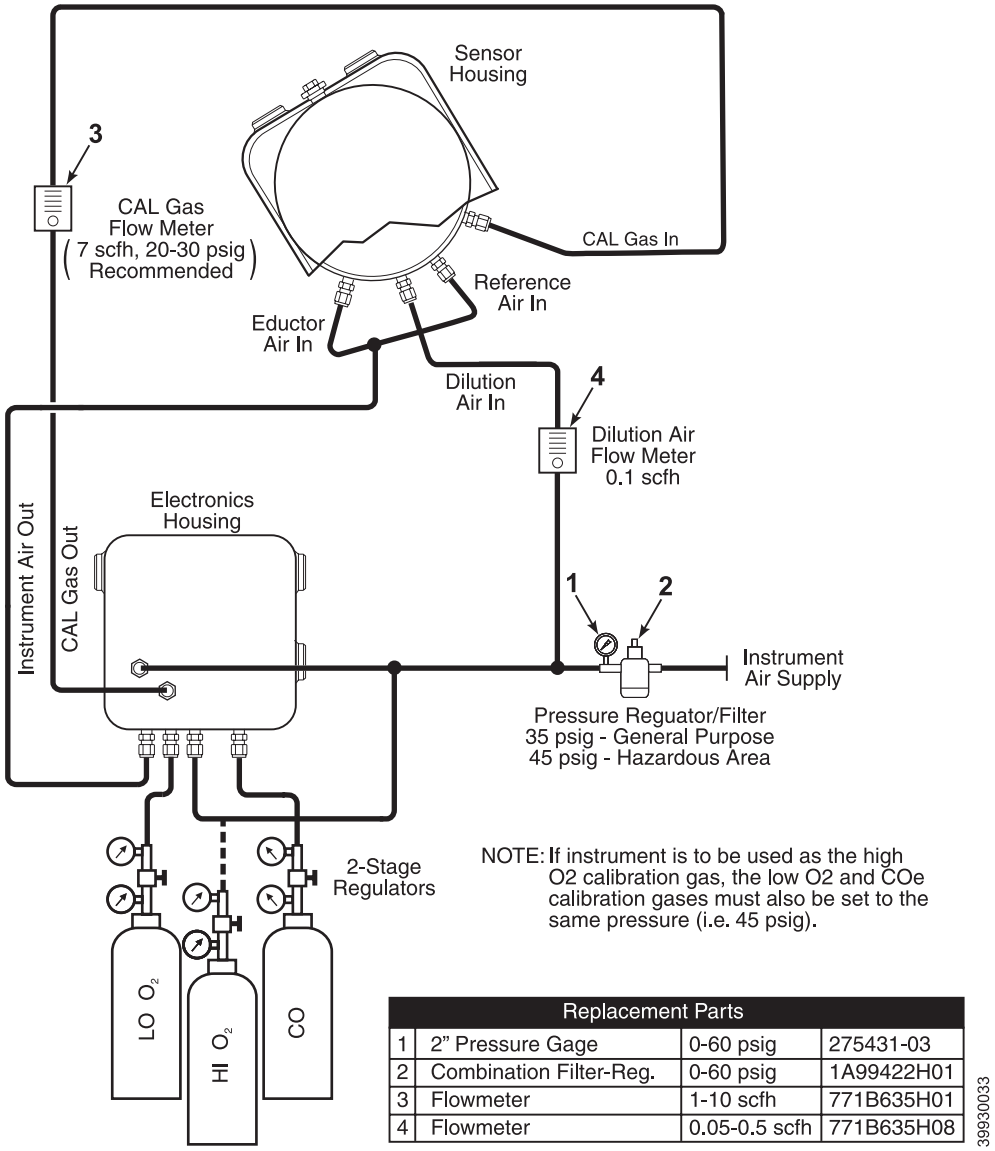
1. Install the reference air set according to the instructions in Reference Air Set Option, steps 1 through 3.
2. Refer to Figure 2-10. Connect the O_2 low gas source to the CAL GAS LO O_2 inlet fitting on the electronics housing. Install a shutoff valve and pressure regulator with gage in the O_2 low supply line, as shown.
3. Connect the O_2 high gas source to the CAL GAS HI O2 inlet fitting. Install a shutoff valve and pressure regulator with gage in the O_2 high supply line.

4. Connect the CO high gas to the CAL GAS HI COe inlet fitting. Install a shutoff valve and pressure regulator with gage in the CO high supply line.
5. Connect the CAL GAS outlet fitting of the electronics housing to the inlet port of the CAL GAS flow meter. Install an air line between the flow meter outlet port and the CAL GAS inlet fitting on the sensor housing.

Reference Air Set and Solenoids Option with COe Zero Function

Figure 2-11 shows the piping arrangement for the Hazardous Area OCX 8800 with autocalibration when the COe Zero Function is used. The arrangement is similar to Figure 2-10 except instrument air is used as the Hi O_2 test gas. Refer to Section 3 for details of this function.

Figure 2-11. Pneumatic Installation, OCX with Reference Air Set, Solenoids and Autocalibration, with COe Zero Function



Replacement Parts			
1	2” Pressure Gage	0-60 psig	275431-03
2	Combination Filter-Reg.	0-60 psig	1A99422H01
3	Flowmeter	1-10 scfh	771B635H01
4	Flowmeter	0.05-0.5 scfh	771B635H08

39930033

Reference Air Set, Solenoids, and Blowback Option with COe Zero Function

Figure 2-13 shows the piping arrangement for the Hazardous Area OCX 8800 with the blowback and autocalibration options when the COe Zero Function is used. The arrangement is similar to Figure 2-12 except instrument air is used as the Hi O_2 test gas. Refer to Sectio 3 for details of the function.

Reference Air Set, Solenoids, and Blowback Option without COe Zero Function

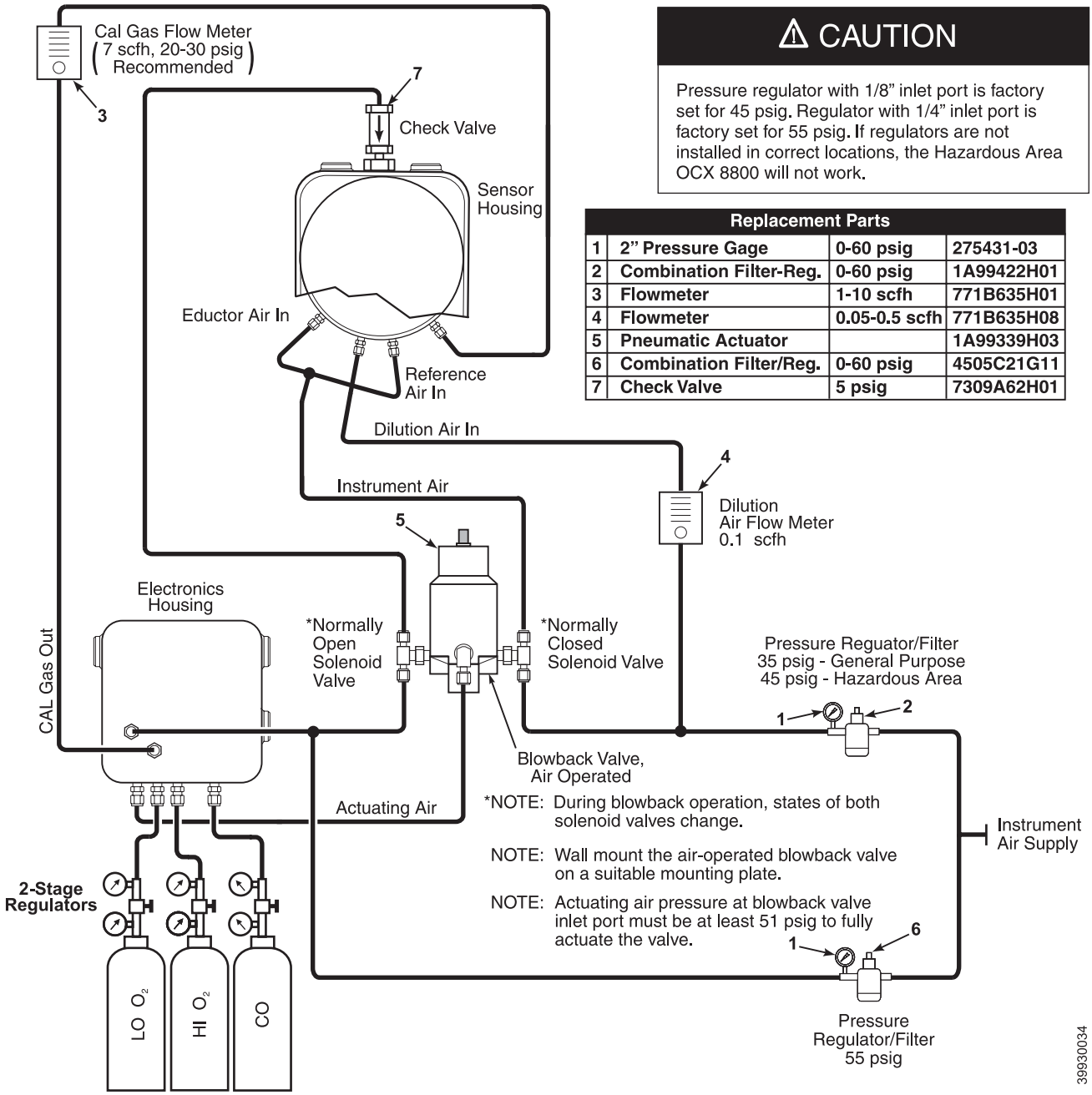
Installing a Hazardous Area OCX 8800 with the blowback option requires the addition of air operated blowback valve, regulator and gage, and check valve.

Figure 2-12 shows the piping arrangement for the Hazardous Area OCX 8800 with the blowback and autocalibration options. Figure 2-14 shows the piping arrangement for the OCX 8800 with the blowback option, but without autocalibration (without test gas solenoids).

When the reference air set, calibration gas solenoids, and blowback options are included with your transmitter, use the following procedure to install the pneumatic system components.

1. Connect the calibration gas sources according to the instructions in the previous paragraph “Reference Air Set and Solenoids Option”, steps 2 through 5.
2. Connect a clean, dry, instrument-quality supply of air (20.95% O_2) to the 45 psig and 55 psig pressure regulators. The inlet to the 45 psig regulator accepts a 1/8" NPT fitting. The inlet to the 55 psig regulator accepts a 1/4" NPT fitting.
3. See the upper leg of the instrument air supply. Connect the output of the 35 psi regulator/filter to one port of the normally-closed air-operated solenoid valve, and to the inlet side of the dilution air flow meter.
4. Connect the dilution air flow meter output to the DILUTION AIR inlet fitting on the sensor housing.
5. Install an instrument air line between the open port of the normally-open air-operated solenoid valve and the tee fitting on the sensor housing.
6. Connect the output of the 55 psi regulator/filter to one port of the normally-open air-operated solenoid valve, and to the instrument air inlet on the back of the electronics housing.
7. Install an air line between the open port of the normally-closed air-operated solenoid valve and the check valve inlet fitting on the sensor housing.
8. Install an air line between the instrument air outlet fitting on the electronics housing and the control air inlet fitting on the air-operated solenoid valve.

Figure 2-12. Pneumatic Installation, OCX with Reference Air Set, Solenoids, Blowback and Autocalibration, without COe Zero Function

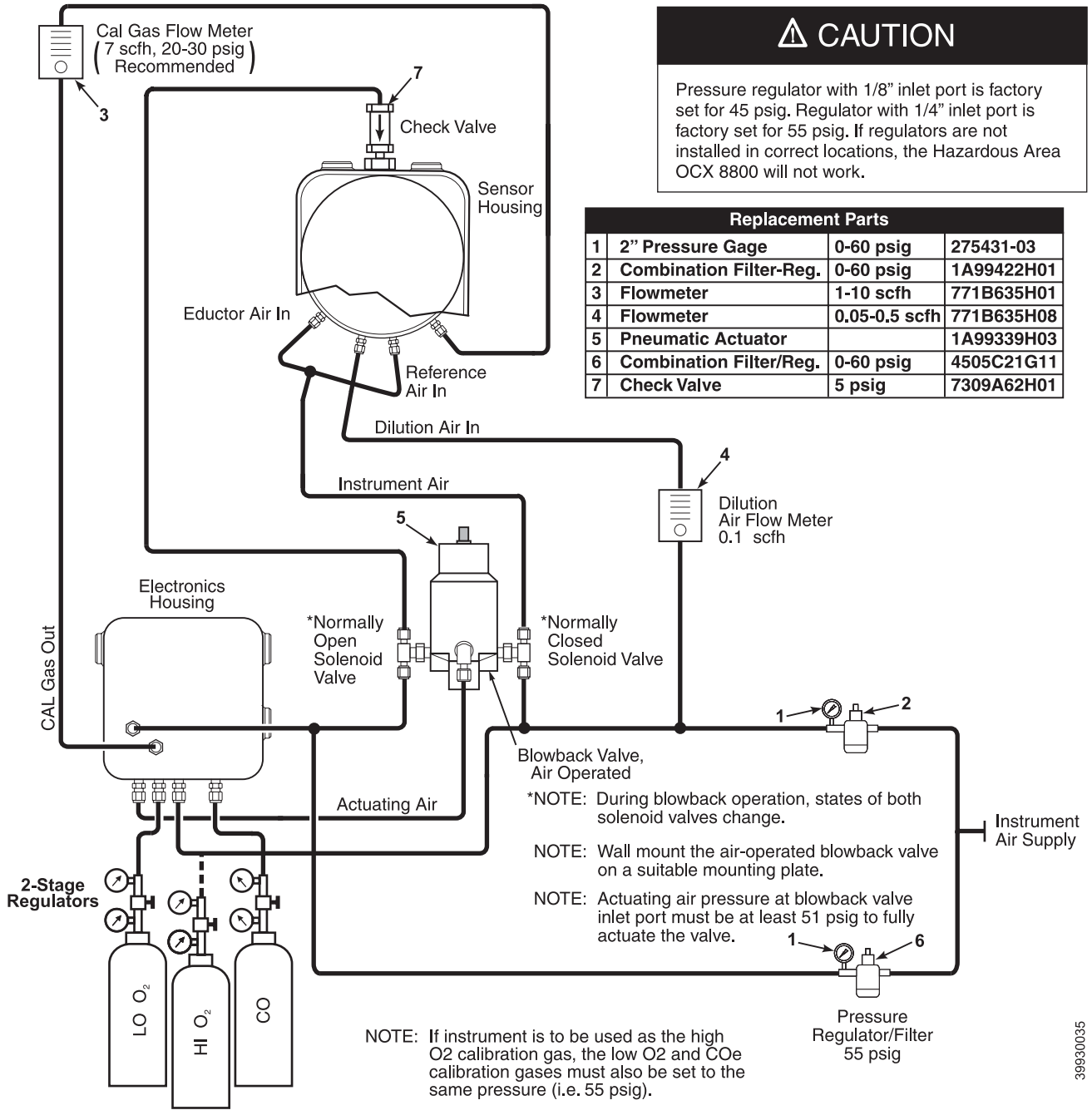


⚠ CAUTION

Pressure regulator with 1/8" inlet port is factory set for 45 psig. Regulator with 1/4" inlet port is factory set for 55 psig. If regulators are not installed in correct locations, the Hazardous Area OCX 8800 will not work.

Replacement Parts			
1	2" Pressure Gage	0-60 psig	275431-03
2	Combination Filter-Reg.	0-60 psig	1A99422H01
3	Flowmeter	1-10 scfh	771B635H01
4	Flowmeter	0.05-0.5 scfh	771B635H08
5	Pneumatic Actuator		1A99339H03
6	Combination Filter/Reg.	0-60 psig	4505C21G11
7	Check Valve	5 psig	7309A62H01

Figure 2-13. Pneumatic Installation, OCX with Reference Air Set, Solenoids, Blowback and Autocalibration, with COe Zero Function


Cal Gas Flow Meter
(7 scfh, 20-30 psig Recommended)
3
7
Check Valve
Sensor Housing
Eductor Air In
Reference Air In
Dilution Air In
Instrument Air
4
Dilution Air Flow Meter 0.1 scfh
5
Electronics Housing
*Normally Open Solenoid Valve
*Normally Closed Solenoid Valve
CAL Gas Out
1
2
Blowback Valve, Air Operated
Actuating Air
*NOTE: During blowback operation, states of both solenoid valves change.
NOTE: Wall mount the air-operated blowback valve on a suitable mounting plate.
NOTE: Actuating air pressure at blowback valve inlet port must be at least 51 psig to fully actuate the valve.
Instrument Air Supply
2-Stage Regulators
LO O2
HI O2
CO
1
6
Pressure Regulator/Filter 55 psig
NOTE: If instrument is to be used as the high O2 calibration gas, the low O2 and COe calibration gases must also be set to the same pressure (i.e. 55 psig).
39930035

⚠ CAUTION

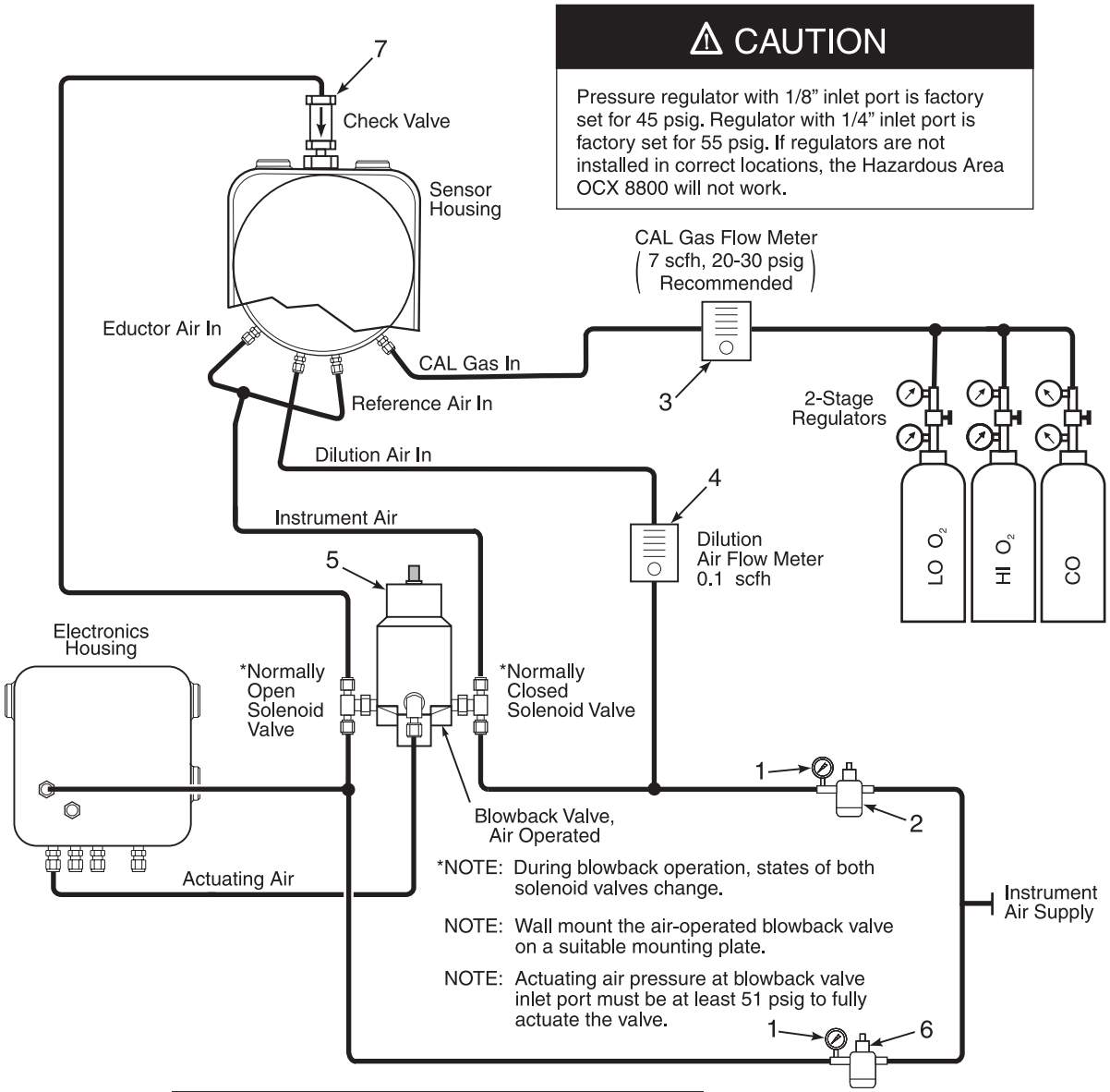
Pressure regulator with 1/8" inlet port is factory set for 45 psig. Regulator with 1/4" inlet port is factory set for 55 psig. If regulators are not installed in correct locations, the Hazardous Area OCX 8800 will not work.

Replacement Parts			
1	2" Pressure Gage	0-60 psig	275431-03
2	Combination Filter-Reg.	0-60 psig	1A99422H01
3	Flowmeter	1-10 scfh	771B635H01
4	Flowmeter	0.05-0.5 scfh	771B635H08
5	Pneumatic Actuator		1A99339H03
6	Combination Filter/Reg.	0-60 psig	4505C21G11
7	Check Valve	5 psig	7309A62H01

Reference Air Set, Solenoids, and Blowback Option with COe Zero Function

Figure 2-13 shows the piping arrangement for the Hazardous Area OCX 8800 with the blowback and autocalibration options when COe Zero Function is used. The arrangement is similar to Figure 2-12 except instrument air is used as the Hi O_2 test gas. Refer to Section 3 for details of this function.

Figure 2-14. Pneumatic Installation, OCX with Reference Air Set and Blowback without Autocalibration


⚠ CAUTION
Pressure regulator with 1/8" inlet port is factory set for 45 psig. Regulator with 1/4" inlet port is factory set for 55 psig. If regulators are not installed in correct locations, the Hazardous Area OCX 8800 will not work.
7
Check Valve
Sensor Housing
Eductor Air In
CAL Gas In
Reference Air In
CAL Gas Flow Meter
(7 scfh, 20-30 psig Recommended)
3
2-Stage Regulators
LO O2
HI O2
CO
Dilution Air In
4
Instrument Air
Dilution Air Flow Meter 0.1 scfh
5
Electronics Housing
*Normally Open Solenoid Valve
*Normally Closed Solenoid Valve
1
2
Blowback Valve, Air Operated
Actuating Air
*NOTE: During blowback operation, states of both solenoid valves change.
NOTE: Wall mount the air-operated blowback valve on a suitable mounting plate.
NOTE: Actuating air pressure at blowback valve inlet port must be at least 51 psig to fully actuate the valve.
Instrument Air Supply
1
6
Pressure Regulator/Filter 55 psig
39930036

Replacement Parts			
1	2" Pressure Gage	0-60 psig	275431-03
2	Combination Filter-Reg.	0-60 psig	1A99422H01
3	Flowmeter	1-10 scfh	771B635H01
4	Flowmeter	0.05-0.5 scfh	771B635H08
5	Pneumatic Actuator		1A99339H03
6	Combination Filter/Reg.	0-60 psig	4505C21G11
7	Check Valve	5 psig	7309A62H01

Reference Air Set and Blowback Panels

An optional blowback panel is shown in Figure 1-9. Piping arrangement for blowback panel without autocalibration without COe Zero Function is shown in Figure 2-15. Piping arangement for blowback panel with autocalibration without COe Zero Function is shown in Figure 2-16. Piping arrangement for blowback panel with autocalibration with COe Zero Function is shown in Figure 2-17.

Figure 2-15. Pneumatic Installation, Blowback Panel without Autocalibration without COe Zero Function

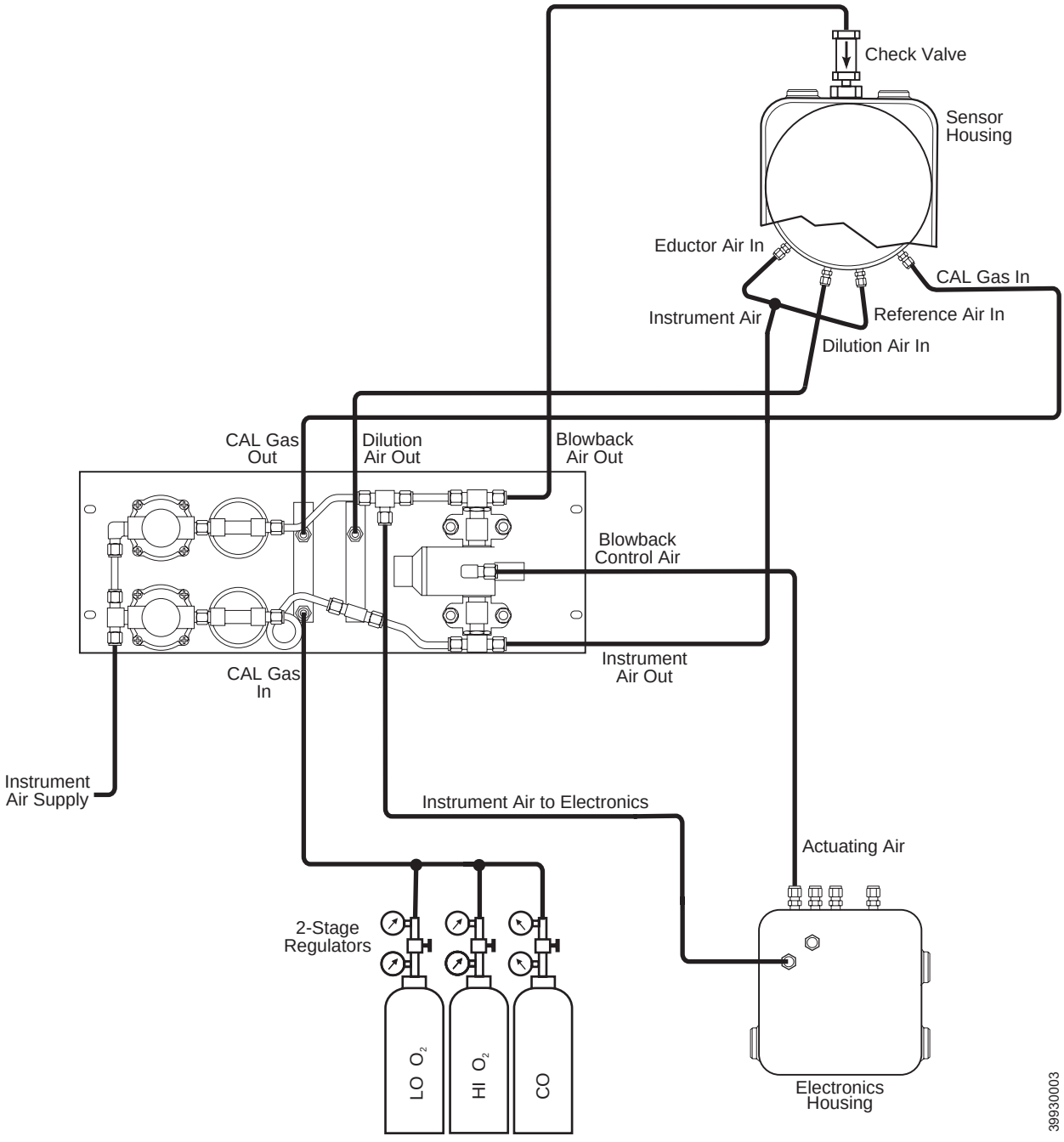


Figure 2-16. Pneumatic Installation, Blowback Panel with Autocalibration without COe Zero Function

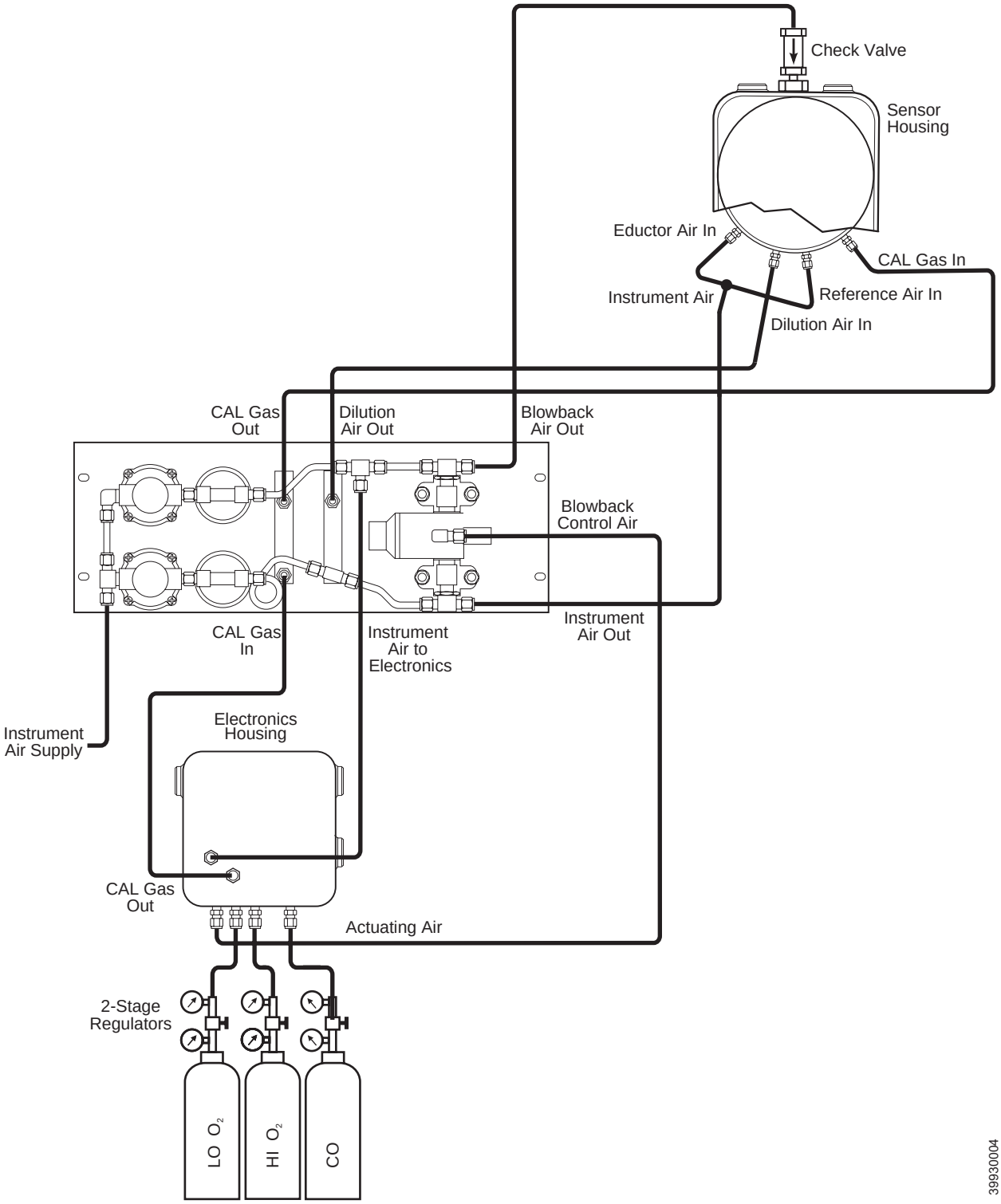
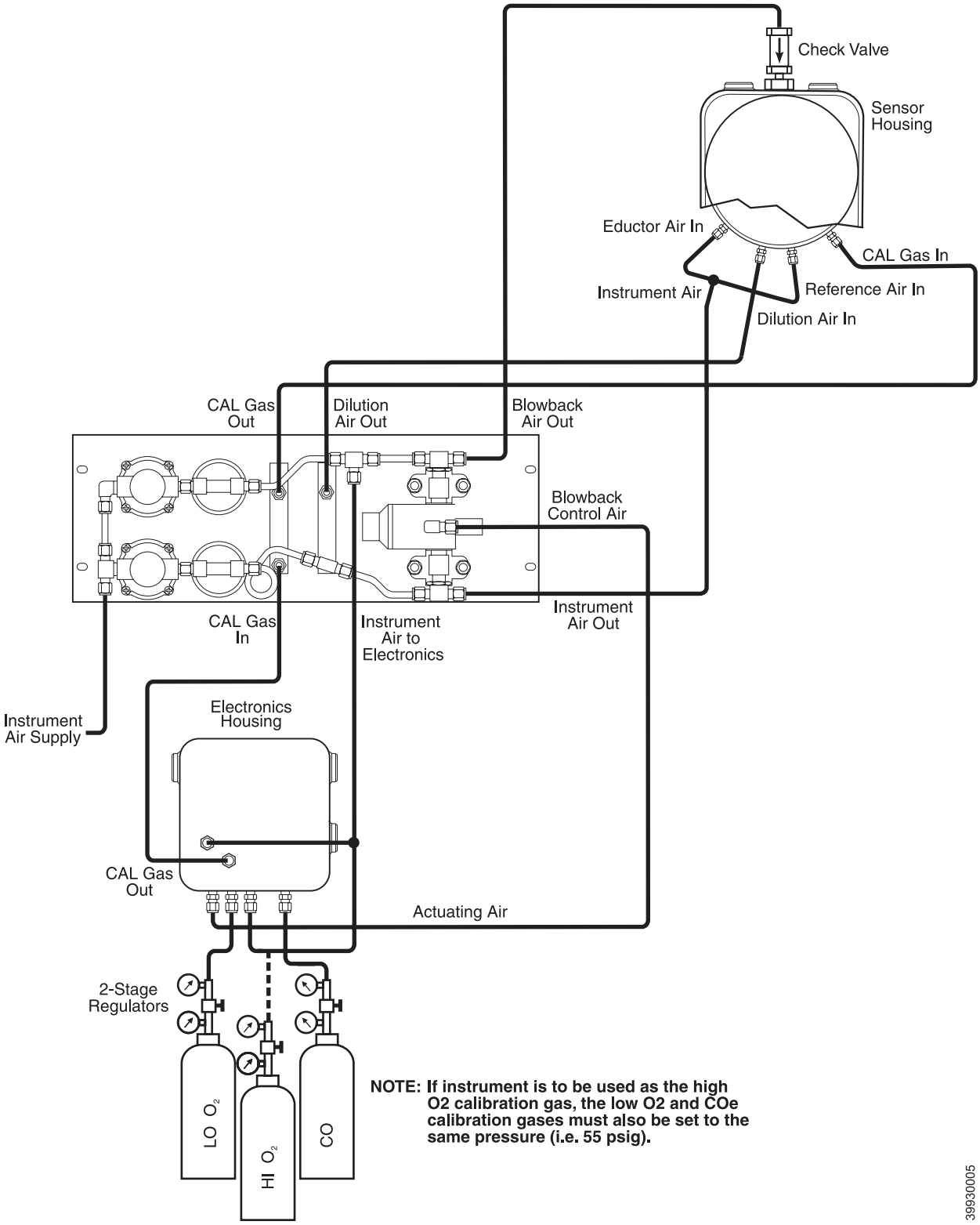


Figure 2-17. Pneumatic Installation, Blowback Panel with Autocalibration with COe Zero Function



INITIAL STARTUP

Observe the following Caution and Note. Refer to Section 3: Configuration and Startup, for Hazardous Area OCX 8800 startup information.

⚠CAUTION

Upon completing installation, make sure that the Hazardous Area OCX 8800 is turned on and operating prior to firing up the combustion process. Damage can result from having a cold Hazardous Area OCX 8800 exposed to the process gases.

If ducts will be washed down during outages, make sure to power down the Hazardous Area OCX 8800 units and remove them from the wash area.

NOTE
During outages, and whenever possible, leave Hazardous Area OCX 8800 units running to prevent condensation and premature aging from thermal cycling.

Section 3 Configuration and Startup

Verify Installation . . . . . page 3-1
Initial Power Up . . . . . page 3-4
Set Test Gas Values . . . . . page 3-4
Calibration Solenoids . . . . . page 3-5
Blowback Feature . . . . . page 3-6
Calibration Verify Feature . . . . . page 3-7
Calibration Tolerance Feature . . . . . page 3-9
COe PURGE / ZERO FEATURE . . . . . page 3-10
OCX 8800 Reset Procedure . . . . . page 3-12

⚠WARNING

Install all protective equipment covers and safety ground leads after installation. Failure to install covers and ground leads could result in serious injury or death.

VERIFY INSTALLATION

Ensure the Hazardous Area OCX 8800 is installed correctly. Verify mechanical installation and all electrical and pneumatic connections. Refer to Section 2, Installation.

⚠CAUTION

Make sure that the Hazardous Area OCX 8800 is turned on and operating prior to firing up the combustion process. Damage can result from having a cold Hazardous Area OCX 8800 exposed to the process gases.

NOTE
During outages, and whenever possible, leave all Hazardous Area OCX 8800 units running to prevent condensation and premature aging from thermal cycling.

Verify Configuration - HART Electronics

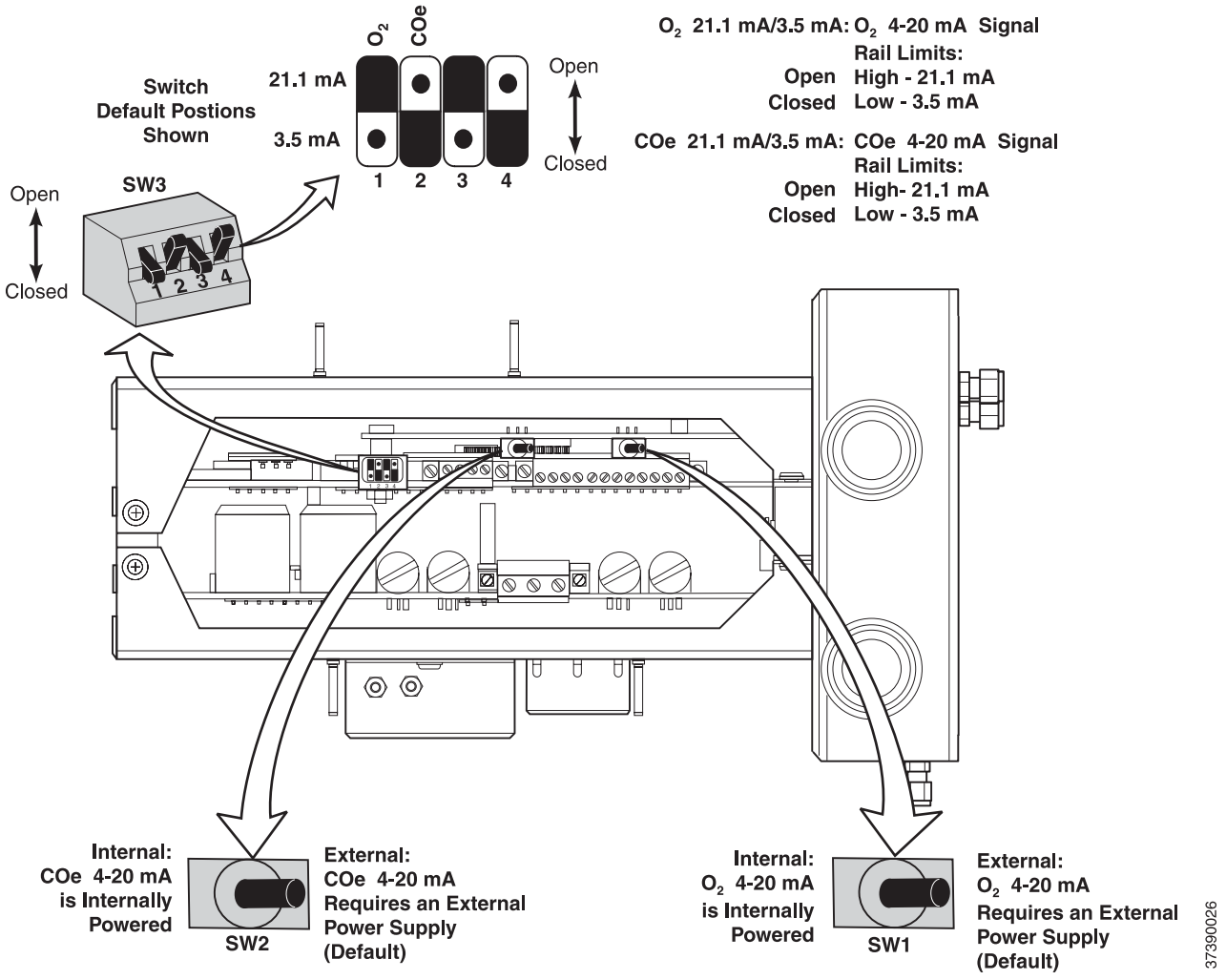
There are three switches on the microprocessor board which are user configurable for the Hazardous Area OCX 8800 with HART electronics (Figure 3-1). SW1 determines if the O_2 4-20 mA signal is internally or externally powered. SW2 determines if the COe 4-20 mA signal is internally or externally powered. SW3 sets the rail limits for the O_2 and COe 4-20 mA signals and configures the sample line heater control circuit. All switches are accessible through holes in the electronics box.

⚠CAUTION

Remove power from the Hazardous Area OCX 8800 before changing defaults. If defaults are changed under power, damage to the electronics may occur.

Verify that the following switch settings are correct for your Hazardous Area OCX 8800 installation:

Figure 3-1. Hazardous Area OCX 8800 Defaults - HART Electronics



SW1 The two settings are internally or externally powering the O_2 4-20 mA signal. The factory setting is for the O_2 4-20 mA signal to be internally powered.

SW2 The two settings are internally or externally powering the COe 4-20 mA signal. The factory setting is for the COe 4-20 mA signal to be internally powered.

SW3 The factory sets this switch as follows:

- Position 1 determines the O_2 4-20 mA signal rail limit. The settings are high, 21.1 mA, or low, 3.5 mA. The factory setting is low, 3.5 mA.
- Position 2 determines the COe 4-20 mA signal rail limit. The settings are high, 21.1 mA, or low, 3.5 mA. The factory setting is high, 21.1 mA.
- Positions 3 and 4 must be set as shown for proper software control of the device heaters.

Verify Configuration - Fieldbus Electronics

There is one switch on the microprocessor board which must be set for the Hazardous Area OCX 8800 with fieldbus electronics (Figure 3-2). SW3 configures the sample line heater control circuit. This switch is accessible through holes in the electronics box.

⚠CAUTION

Remove power from the Hazardous Area OCX 8800 before changing defaults. If defaults are changed under power, damage to the electronics may occur.

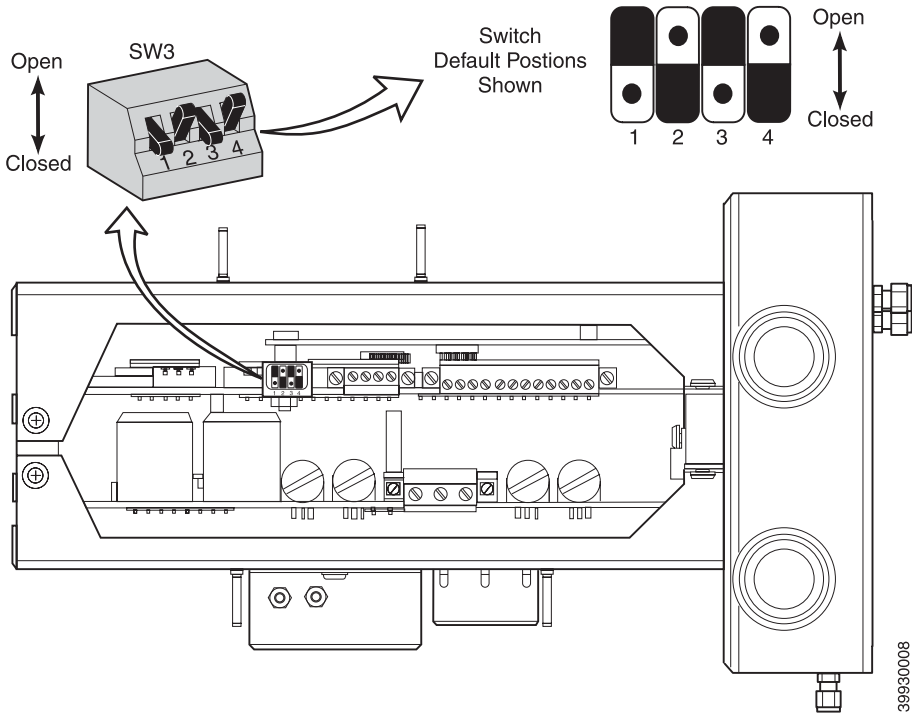


Figure 3-2. Hazardous Area OCX 8800 Defaults - Fieldbus Electronics

Verify that the following switch settings are correct for your Hazardous Area OCX 8800 installation:

SW3 The factory sets this switch as follows:

- Position 1 not used.
- Position 2 not used.
- Positions 3 and 4 must be set as shown for proper software control of the device heaters.

INITIAL POWER UP

Allow adequate time (approximately 60 minutes) for the heaters to begin operation and for the Hazardous Area OCX 8800 to reach normal operating temperature on power up. Normal operating temperature for the O_2 cell is 736°C. Normal operating temperature for the combustibles cell is 300°C. The normal sample line temperature is 170°C. During this time the eductor air solenoid will remain closed so no sample is pulled through the analyzer. When the OCX reaches operating temperature the solenoid will energize, eductor air will begin to flow, and the unit will begin normal operation.

SET TEST GAS VALUES

Use Field Communicator or the optional LOI to set test gas values for calibration. Refer to Section 4, Using the LOI or Section 6, Field Communicator for more information.

Setting Test Gas Values with the Field Communicator

1. Use the 375 Field Communicator software to access the HART menu.
2. From the **DETAILED SETUP** menu, select **CAL SETUP**.
3. From the **CAL SETUP** menu, select **O2 CAL PARAMS** or **COe CAL PARAMS**.
4. From **O2 CAL PARAMS**, select **O2 HIGH GAS**. Enter the percent O_2 used for the high O_2 test gas.
5. From **O2 CAL PARAMS**, select **O2 LOW GAS**. Enter the percent O_2 used for the low O_2 test gas.
6. From **COe CAL PARAMS**, select **COe Test Gas**. Enter the CO concentration (ppm) used for COe test gas.

Setting Test Gas Values with Fieldbus Communicator

1. Use the 375 Field Communicator software to access the Fieldbus menu.
2. From the **TRANSDUCER** menu, select **O2 CAL.**
3. From **O2 CAL** menu select **O2 CAL SETUP.**
4. From **O2 CAL SETUP**, select **O2 HIGH GAS**. Enter the percent O_2 used for the high test gas.
5. From **O2 CAL SETUP**, select **O2 LOW GAS**. Enter the percent O_2 used for the low test gas
6. From the **TRANSDUCER** menu select **COe CAL SETUP**.
7. From **COe CAL SETUP**, select **COe Test Gas**. Enter the CO concentration (ppm) used for the COe Test Gas.

Setting Test Gas Values with the LOI

1. Use the "Z" pattern to enter the LOI menu tree.
2. From the **SYSTEM** menu, select **Calib Setup**.
3. From **Calib Setup**, select **O2 High Gas %**. Enter the percent O_2 used for the high O_2 test gas.
4. Select the down arrow and the next selection will be **O2 Low Gas %**. Enter the percent O_2 used for the low O_2 test gas.
5. Select the down arrow several times to display **COe Test Gas**. Enter the CO concentration (ppm) used for COe test gas.

CALIBRATION SOLENOIDS

The Hazardous Area OCX 8800 can be provided with optional calibration solenoids for the purpose of performing autocalibration. The solenoids are controlled by the Hazardous Area OCX 8800 software and automatically switch in the proper calibration gas during the calibration cycle.

A Hazardous Area OCX 8800 shipped from the factory with calibration solenoids must be configured before autocalibration can be implemented. This same process must be performed any time a replacement card stack is installed.

Configuring the Calibration Solenoids with the Field Communicator - HART

1. Use the 375 Field Communicator to access the HART menu.
2. From the **DETAILED SETUP** menu, select **CAL SETUP**.
3. From the **CAL SETUP** menu, select **O2 CAL PARAMS/COe CAL PARAMS**.
4. From the **O2 CAL PARAMS/COe CAL PARAMS**, select **Solenoids**. Select **Yes** to enable the solenoids.

Configuring the Calibration Solenoids with the Field Communicator - Fieldbus

1. Use the 375 Field Communicator to access the Fieldbus menu.
2. From the **TRANSDUCER** block menu, select **O2 CAL/COE CAL**.
3. From the **O2 CAL/COE CAL** menu, select **O2 CAL SETUP/COE CAL SETUP**.
4. From the **O2 CAL SETUP/COE CAL SETUP**, select **Solenoids**. Select **Present** to enable the solenoids.

Configuring the Calibration Solenoids with the LOI

1. Use the "Z" pattern to enter the LOI menu tree.
2. From the **SYSTEM** menu, select **Calib Setup**.
3. From the **Calib Setup** menu, select **Use Solenoids**. Select **Yes** to enable the solenoids.

BLOWBACK FEATURE

The blowback feature blows instrument air back through the center of the internal filter and out the sample tube of the probe. This removes built up dirt and particulate from the internal filter, sample line and any optional in-situ filter on the end of the sample tube. The blowback feature is normally used in systems that have heavy particulate in the process stream.

The blowback feature requires the optional blowback hardware to be properly installed external to the Hazardous Area OCX 8800. See Section 2, Pneumatic Installation, for details.

A Hazardous Area OCX 8800 shipped from the factory must be configured before blowback can be implemented. This same process must be performed any time a replacement card stack is installed.

Configuring Blowback with the Field Communicator - HART

1. Use the 375 Field Communicator or AMS software to access the HART menu.
2. From the **DETAILED SETUP** menu, select **INPUT/OUTPUT**.
3. From the **INPUT/OUTPUT** menu, select **BLOWBACK**.
4. From the **BLOWBACK**, select **BlBk Enabled**. Select **Yes** to enable blowback. Also set the following parameters:

   BlBk Intrvl - Length of time between blowback events (60 minutes recommended).

   BlBk Period - Length of time blowback is activated (5 seconds recommended).

   BlBk Purge Time - Length of time after blowback is complete before oxygem/combustibles readings are considered valid (Set as required by the application).
5. Manually initiate blowback from DIAG/SERVICE, then BLOW BACK, When select BLOWBACK.
6. Configuring Blowback with the Field Communicator - Fieldbus

1. Use the 375 Field Communicator or AMS software to access the Fieldbus menu.
2. From the **TRANSDUCER** block menu, select **Alarm Relay/Blowback**.
3. From the **Alarm Relay/Blowback** menu, select **Blowback**.
4. From the **Blowback** menu, select **Blowback Enabled**. Also set the following parameters:

   Blowback Interval - Length of time between blowback events (60 minutes recommended).

   Blowback Period - Length of time blowback is activated (5 seconds recommended).

   Blowback Purge Time - Length of time after blowback is complete before oxygem/combustibles readings are considered valid (Set as required by the application).

   Initiate Blowback - Initiates a blow back event manually.

Configuring Blowback with the LOI

1. Use the "Z" pattern to enter the LOI menu tree.
2. From the **SYSTEM** menu, select **Blow Back**.
3. From the **Blow Back** menu, select **Blow Bk Enable**. Select **Yes** to enable blowback. Also set the following parameters:

   Blow Bk Intrvl - Length of time between blowback events. Range is 0 to 32,000 minutes. Default is 60 minutes. 60 minutes is recommended.

   Blow Bk Period - Length of time blowback in activated. Range is 1 to 5 seconds. Default is 2 seconds. 5 seconds is recommended.

   Blow Bk Purge - Length of time after blowback is complete before oxygem/combustibles readings are considered valid. Range is 0 to 500 seconds. Default is 88 seconds. Set as required by the application.

   Force Blow Bk - Initiates a blow back event manually.

CALIBRATION VERIFY FEATURE

The calibration verify feature flows one or more calibration gases to verify the analyzer is reading correctly. The calibration verify feature flows each calibration gas on demand to verify calibration, but does not change the slope or constant of the current calibration. This function uses the same gas flow and purge times from the basic calibration setup.

The calibration verify feature is only valid if the Hazardous Area OCX 8800 is supplied with calibration solenoids and the solenoids have been activated.

⚠WARNING

During the Calibration Verify function the analog output signals will track the oxygen and combustibles readings. To avoid a potentially dangerous operating condition, the Hazardous Area OCX 8800 must be removed from the automatic combustion control loop before performing the Calibration Verify procedure.

Performing a Calibration Verify with the Field Communicator - HART

1. Use the 375 Field Communicator or AMS software to access the HART menu.
2. From the **DEVICE SETUP** menu, select **DIAG/SERVICE**.
3. From the **DIAG/SERVICE** menu, select **CALIBRATION**.
4. From the **CALIBRATION**, select **CAL VERIFY**. Select **Verify Calibration**. From this menu, select the functions as follows:

   Flow High O2 Gas - Flows the high O2 test gas for the time specified in the calibration setup.

   Flow Low O2 Gas - Flows the low O2 test gas for the time specified in the calibration setup.

   Flow High COe Gas - Flows the COe test gas for the time specified in the calibration setup.

   Purge Gas - Initiates a delay for the specified purge time before oxygen/combustibles readings are considered valid.

NOTE
A **Purge** will automatically follow a gas flow.

Performing a Calibration Verify with the Field Communicator - Fieldbus

1. Use the 375 Field Communicator or AMS software to access the Fieldbus menu.
2. From the **TRANSDUCER** block menu, select **METHODS**.
3. Set the **Mode** to **OOS** (Out of Service) before starting the Calibration Verify process.
4. From the **METHODS** menu, select **OCX Cal Verify**. From this menu, select the functions as follows:

   Flow High O2 Gas - Flows the high O2 test gas for the time specified in the calibration setup.

   Flow Low O2 Gas - Flows the low O2 test gas for the time specified in the calibration setup.

   Flow High COe Gas - Flows the COe test gas for the time specified in the calibration setup.

   Purge Gas - Initiates a delay for the specified purge time before oxygen/combustibles readings are considered valid.

NOTE
A **Purge** will automatically follow a gas flow.

Performing a Calibration Verify with the LOI

1. Use the "Z" pattern to enter the LOI menu tree.
2. From the **CALIBRATION** menu, select **Cal Verify**.
3. From the **Cal Verify** menu, select the functions as follows:

   Flow High Gas - Flows the high O2 test gas for the time specified in the calibration setup.

   Flow Low Gas - Flows the low O2 test gas for the time specified in the calibration setup.

   Flow COe Gas - Flows the COe test gas for the time specified in the calibration setup.

   Purge - Initiates a delay for the specified purge time before oxygen/combustibles readings are considered valid.

NOTE
A **Purge** will automatically follow a gas flow.

CALIBRATION TOLERANCE FEATURE

The calibration tolerance feature provides a mechanism to fail a calibration if the calibration measurement does not fall within a specific tolerance of the test gas value. The tolerance is preset within the Hazardous Area OCX 8800 software and is not user adjustable. The tolerance is different between the oxygen and combustibles test gases. For oxygen, the calibration will fail if the measured value differs by more than ±10% of the configured value. For combustibles, the calibration will fail if the measured value differs by more than ±30% of the configured value.

A Hazardous Area OCX 8800 shipped from the factory must be configured before the calibration tolerance feature can be implemented. This same process must be performed any time a replacement card stack is installed.

Configuring the Calibration Tolerance Feature with the Field Communicator - HART

1. Use the 375 Field Communicator or AMS software to access the HART menu.
2. From the **DETAILED SETUP** menu, select **CAL SETUP**.
3. From the **CAL SETUP** menu, select **O2 CAL PARAMS**.
4. To enable the calibration tolerance feature for the oxygen calibration, from the **O2 CAL PARAMS**, select **O2 Tol Check**. Select **On** to enable the calibration tolerance feature.
5. Back out to the **CAL SETUP** menu, select **COe CAL PARAMS**.
6. To enable the calibration tolerance feature for the combustibles calibration, from the **COe CAL PARAMS**, select **COe Tol Check**. Select **On** to enable the calibration tolerance feature.

Configuring the Calibration Tolerance Feature with the Field Communicator - Fieldbus

1. Use the 375 Field Communicator or AMS software to access the Fieldbus menu.
2. From the **TRANSDUCER** block menu, select **O2 CAL/COe CAL**.
3. From the **O2 CAL/COe CAL** menu, select **O2 CAL SETUP/COe CAL SETUP**.
4. From the **O2 CAL SETUP/COe CAL SETUP** menu, select **O2 Tolerance Check/COe Tolerance Check**. Select **Yes** to enable the calibration tolerance feature.

Configuring the Calibration Tolerance Feature with the LOI

1. Use the "Z" pattern to enter the LOI menu tree.
2. From the **SYSTEM** menu, select **Calib Setup**.
3. From the **Calib Setup** menu, select the following:

   O2 Tol Check - Select **Yes** to enable the calibration tolerance feature for the oxygen calibration.

   Comb Tol Check - Select **Yes** to enable the calibration tolerance feature for the combustibles calibration.

COe PURGE / ZERO FEATURE

This feature provides a way to periodically flood the COe sensor with air to perform two functions; a) provide additional oxygen to help burn off any combustible residue from the COe sensor, and b) allow for optional adjustment of the COe calibration constant. If the OCX8800 is configured to update the COe calibration constant, only the constant is updated. The COe calibration slope is not affected. To update both the constant and slope a full calibration must take place.

The feature uses the calibration solenoid that is also used for high O2 test gas and COe zero gas. For the feature to work properly, instrument air is used as the high O2 test gas. This also requires the high O2 test gas value to be set at 20.95%.

As an option, a two way valve may be installed to switch the high O2 test gas between the normal calibration gas and instrument air. This allows the Hazardous Area OCX 8800 to use a specified calibration gas for calibration, then instrument air for the COe zero feature. Switching between the two gases must be manually coordinated between scheduled calibrations and COe zero events.

When the COe zero feature is used, special pneumatic connections are required. See Section 2, Pneumatic Installation, for details.

The COe zero feature is only valid if the Hazardous Area OCX 8800 is supplied with calibration solenoids and the solenoids have been activated.

A Hazardous Area OCX 8800 shipped from the factory must be configured before the COe zero feature can be implemented. This same process must be performed any time a replacement card stack is installed.

⚠WARNING

During the COe Zero Function the analog output signals may track the oxygen and combustibles readings if configured to do so. To avoid a potentially dangerous operating condition, the Hazardous Area OCX 8800 must be removed from the automatic combustion control loop before performing the COe Zero Function procedure.

⚠WARNING

At the completion of the COe Zero Function, the COe analog output signal will change if the Zero Update parameter is set to "Yes".

Configuring the COe Zero Feature with the Field Communicator - HART

1. Use the 375 Field Communicator or AMS software to access the HART menu.
2. From the **DETAILED SETUP** menu, select **INPUT/OUTPUT**.
3. From the **INPUT/OUTPUT** menu, select **COE ZERO**.
4. From the **COE ZERO** menu, select the functions as follows:

   Zero Enabled - Select "Yes" or "No" to enable or disable this feature.

   Zero Intrvl - Length of time between COe zero events. Range is 60 to 480 minutes. Default is 60 minutes.

Zero Flow - Length of time COe zero gas flows. Range is 120 to 600 seconds. Default is 120 seconds.

Zero Purge - Length of time after COe zero is complete before oxygen/combustibles readings are considered valid. Range is 60 to 180 seconds. Default is 60 seconds. Total duration of this function is flow time plus purge time.

Zero Tracks - Determines if the analog output signals track or hold during the function. Valid choices are None, Both, COe, and O2.

Zero Update - Determines if the COe calibration constant is updated at the end of the function. Valid choices are Yes and No. A Yes choice will cause the COe calibration constant to update.

Configuring the Calibration Tolerance Feature with the Field Communicator - Fieldbus

1. Use the 375 Field Communicator or AMS software to access the Fieldbus menu.
2. From the **TRANSDUCER** block menu, select **COe ZERO**.
3. From the **COe ZERO** menu, select the functions as follows:

   COe Zero Enable - Select "Yes" or "No" to enable or disable this feature.

   COe Zero Interval - Length of time between COe zero events. Range is 60 to 480 minutes. Default is 60 minutes.

   COe Zero Duration - Length of time COe zero gas flows. Range is 120 to 600 seconds. Default is 120 seconds.

   COe Zero Purge Time - Length of time after COe zero is complete before oxygen/combustibles readings are considered valid. Range is 60 to 180 seconds. Default is 60 seconds. Total duration of this function is flow time plus purge time.

   COe Zero Output Track - Determines if the analog output signals track or hold during the function. Valid choices are None, Both, COe, and O2.

   COe Zero Update - Determines if the COe calibration constant is updated at the end of the function. Valid choices are Yes and No. A Yes choice will cause the COe calibration constant to update.

Configuring the COe Zero Feature with the LOI

1. Use the "Z" pattern to enter the LOI menu tree.
2. From the **SYSTEM** menu, select **Input/Output**.
3. From the **Input/Output** menu, select **COe Zero**. Select the functions as follows:

   COe Zero Enable - Select "Yes" or "No" to enable or disable this feature.

   COe Zero Intrvl - Length of time between COe zero events. Range is 60 to 480 minutes. Default is 60 minutes.

   COe Zero Flow - Length of time COe zero gas flows. Range is 120 to 600 seconds. Default is 120 seconds.

COe Zero Purge - Length of time after COe zero is complete before oxygen/combustibles readings are considered valid. Range is 60 to 180 seconds. Default is 60 seconds. Total duration of this function is flow time plus purge time.

COe Zero Tracks - Determines if the analog output signals track or hold during the function. Valid choices are None, Both, COe, and O2.

COe Zero Update - Determines if the COe calibration constant is updated at the end of the function. Valid choices are Yes and No. A Yes choice will cause the COe calibration constant to update.

OCX 8800 RESET PROCEDURE

Whenever you correct an equipment alarm or fault condition, the Hazardous Area OCX 8800 will either revert to normal operation or continue to indicate an alarm status condition. If the equipment does not revert to normal operation when a fault condition is cleared, or if instructed to do so in Section 8, Troubleshooting, use the following procedure to reset the Hazardous Area OCX 8800.

OCX Reset with the LOI

1. Use the "Z" pattern to enter the LOI menu tree. (Refer to Section 4, Using the LOI).
2. Select the **SYSTEM** submenu.
3. From the **SYSTEM** submenu, select the **Status** submenu.
4. From the **Status** submenu, select **Reset Device**. The Hazardous Area OCX 8800 will reset and the LOI will revert to the normal operation display.

OCX Reset with the Field Communicator

Remove the Hazardous Area OCX 8800 from the process loop and recycle power.

Section 4 Using the LOI

Overview . . . . . **page 4-1**
Display Orientation . . . . . **page 4-1**
LOI Controls . . . . . **page 4-2**
LOI Menu Tree . . . . . **page 4-4**

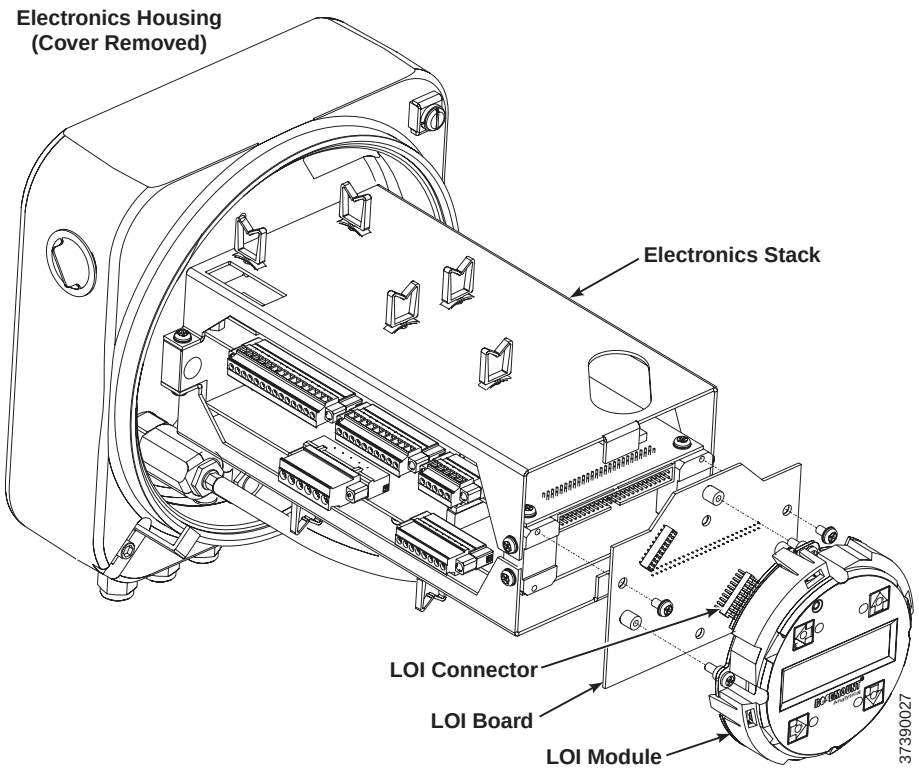
OVERVIEW

This section describes the installation and operation of the LOI module in the Hazardous Area OCX 8800.

DISPLAY ORIENTATION

The LOI module mounts to a connector on the LOI board. The board is installed on the end of the electronics stack in the electronics housing, Figure 4-1. There are four mating connectors on the back of the LOI module that allow the LOI to be oriented as desired by the user.

Figure 4-1. LOI Components Mounting



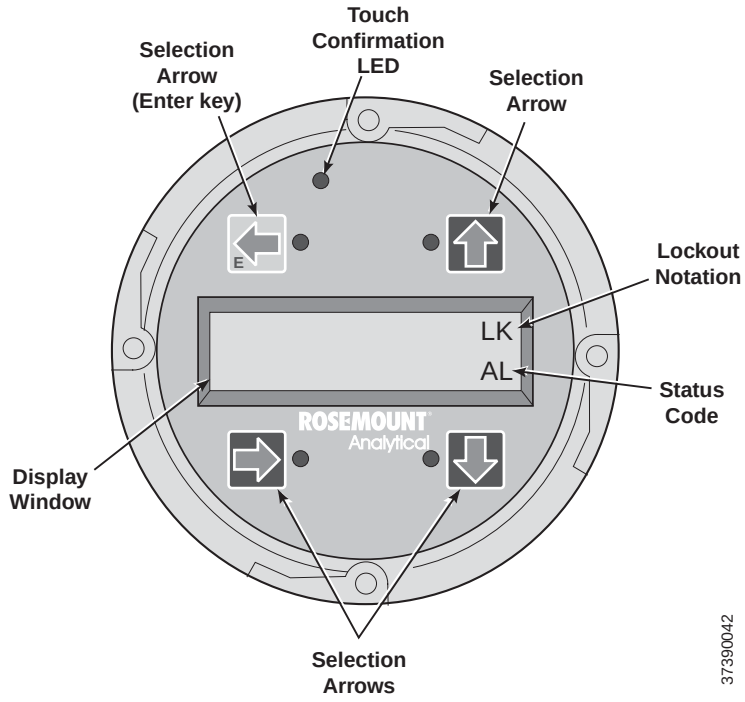
LOI CONTROLS

Overview

The LOI, shown in Figure 4-2, utilizes a bright blue gas-fluorescent display. Intensity is adjustable. There is an Infrared LED source and a detector for each key. The detectors can detect a finger placed above the button through the glass window. There is no need to open the instrument in bad weather or in hazardous areas in order to access the electronics.

It should be noted that the Hazardous Area OCX 8800 also uses HART or FOUNDATION Fieldbus communications, permitting access to all instrument functionality anywhere the digital O_2 signal terminates via a model 375 Field communicator.

Figure 4-2. LOI Assembly



LOI Key Functions

The gray (top left) key will move one level higher in the menu structure. When entering parameter values (numbers), this key moves the cursor to the left. The left-pointing key also doubles as an Enter key, used after the digits of a parameter value are entered, and the cursor is moved to its left-most position. When the Enter key is touched, the new parameter value, if accepted, will appear in the top line of the display.

The blue (bottom left) key acts as a selector when choosing from among several menu items. This right-pointing key also will move the cursor to the right when entering the digits of a new parameter value.

The up and down-pointing keys are used to increment up and down when selecting from a vertical list of menu items. These keys are also used for incrementing values up and down for new data input.

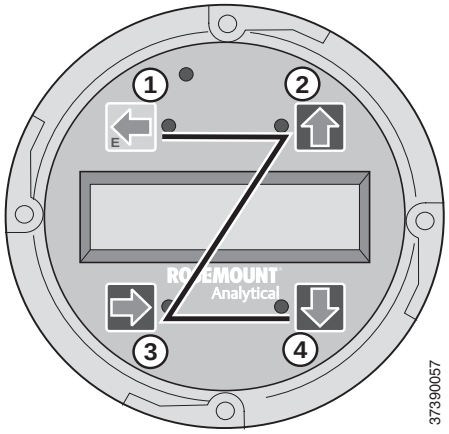
Lockout

The LOI has a lockout feature that prevents nuisance actuation by someone brushing against the glass window, raindrops, dirt, insects, etc. This lockout mode is automatically established when no buttons are pushed for 30 seconds (default). This countdown to lockout is configurable.

In order to unlock the display, input a "Z" pattern (Figure 4-3). First, touch the top left (gray) Enter key. Next, touch the top right key, followed by the bottom left key and the bottom right key. The **LK** notation in the upper right corner of the display will disappear. Touch the Enter key once more to enter into the menu structure. Whenever a key is touched additional time to lockout is provided, so that the lockout feature does not become a nuisance. This additional revert time is one hour (default) and is also user configurable.

NOTE
Always clean dust and soil away from the LOI screen each time the LOI is used. Excessive dust can prevent the LOI from entering lockout. This condition can cause uncommanded operations to occur.

Figure 4-3. 'Z' Pattern Entry



LOI Status Codes

The LOI display shows a status code in the lower right hand corner of the display. There are nine status codes to indicate the existing status of the device during operation. The status code descriptions are shown in Table 4-1.

Table 4-1. LOI Status Codes

CODE	DESCRIPTION
AL	**Alarm** - The device is in a recoverable alarm state.
BL	**Blowback** - A blowback cycle is active.
CA	**Calibration** - A calibration cycle is active.
CV	**Calibration Verify** - A calibration verify task is in progress.
NM	**Normal** - The device is in a normal operating mode.
PO	**Power On** - A system level initialization sequence is active. This will continue for several seconds.
SF	**System Fault** - The device is in a non-recoverable alarm condition. The unit must be reset or power must be cycled off and on to resume operation.
ST	**Stabilize** - The device heater control is stabilizing (after warm up). Sensors are warming up to operating temperature.
WU	**Warm Up** - The device heaters are ramping up to operating temperature.
CZ	**COe Zero** - The COe Zero cycle is active.

LOI MENU TREE

This section consists of a menu tree for the LOI on the Hazardous Area OCX 8800, Figure 4-4. This menu is specific to the Hazardous Area OCX 8800.

First Column Submenus

From the operating display (O_2% and COe ppm), the left-pointing Enter key is the only option to move into the first column submenus of the LOI menu tree. The first column contains three submenus: **SENSOR DATA**, Figure 4-4 sheet 1 of 4, **CALIBRATION**, sheet 2 of 4, and **SYSTEM**, sheets 3 and 4 of 4. From the operating display, **SENSOR DATA** is displayed when the right-pointing key is selected. Use the up or down-pointing key to move to the other first column submenus.

Second Column Submenus

From the first column submenus, selecting the right-pointing key moves the display into the second column submenus. The up and down-pointing keys allow the display to move to the second column submenus of the first column submenu selected. The left-pointing key moves the display back to the first column submenu.

Third and Fourth Column Submenus

From the second column submenus, selecting the right-pointing key moves the display into the third column submenus. The third column submenu may be another menu or a list of parameters. The up- and down-pointing keys allow the display to move to the different parameters or menus. The third or fourth column submenu may be a parameter list. When a parameter list is displayed, the cursor will blink. The up- and down-pointing keys select the value for the parameter displayed.

Figure 4-4. LOI Menu Tree
(Sheet 1 of 4)

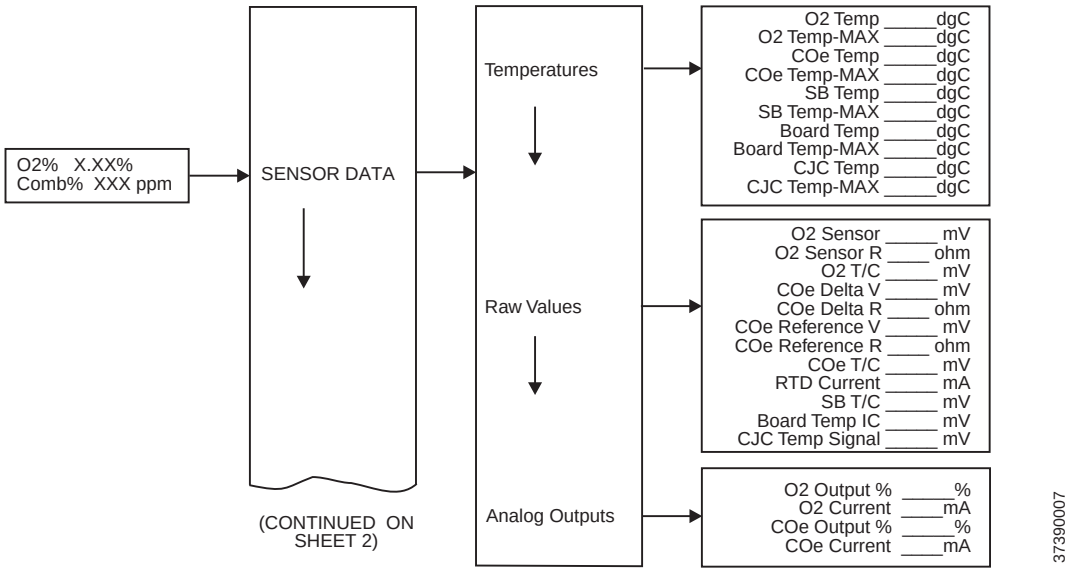


Figure 4-4. LOI Menu Tree
(Sheet 2 of 4)

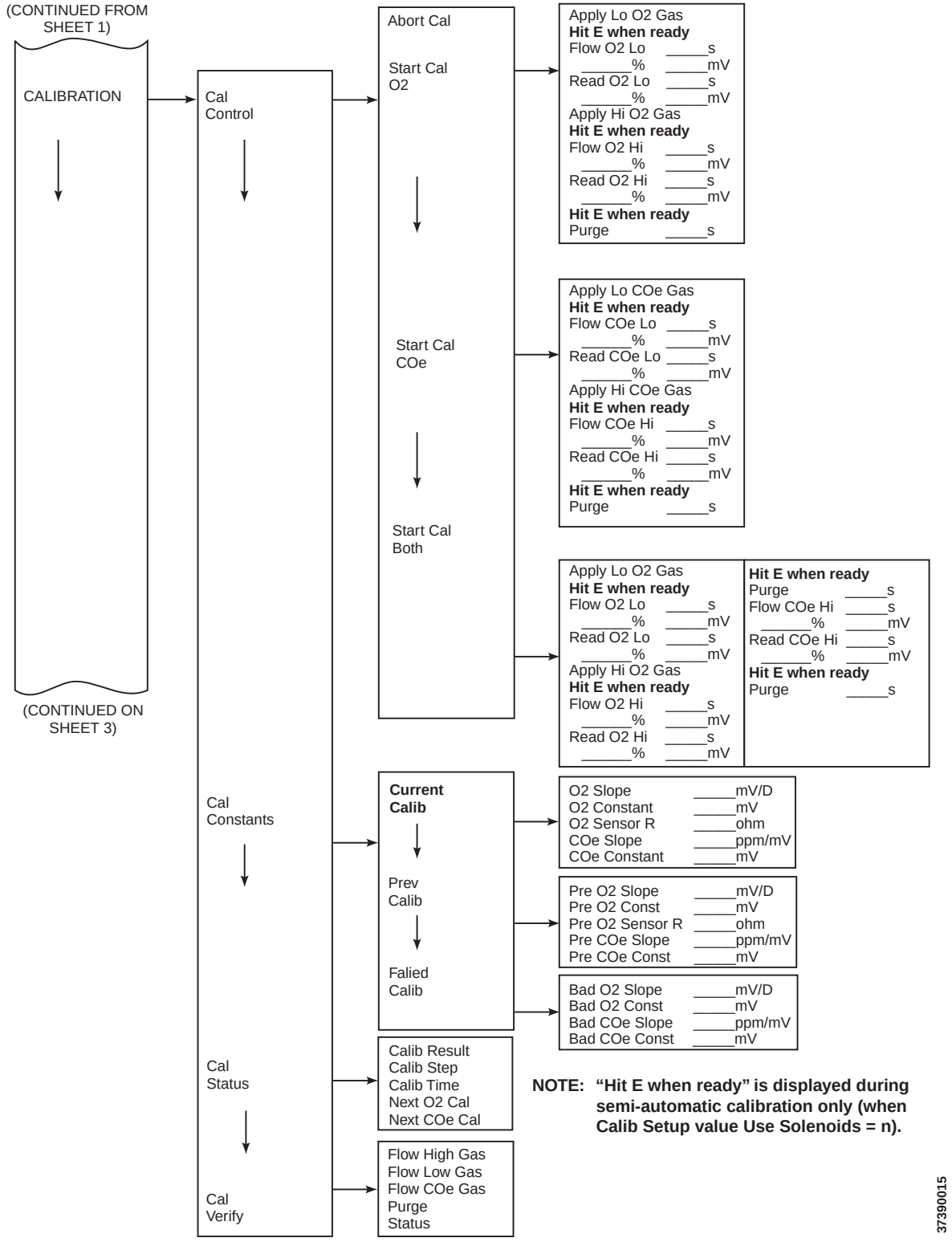


Figure 4-4. LOI Menu Tree
(Sheet 3 of 4)

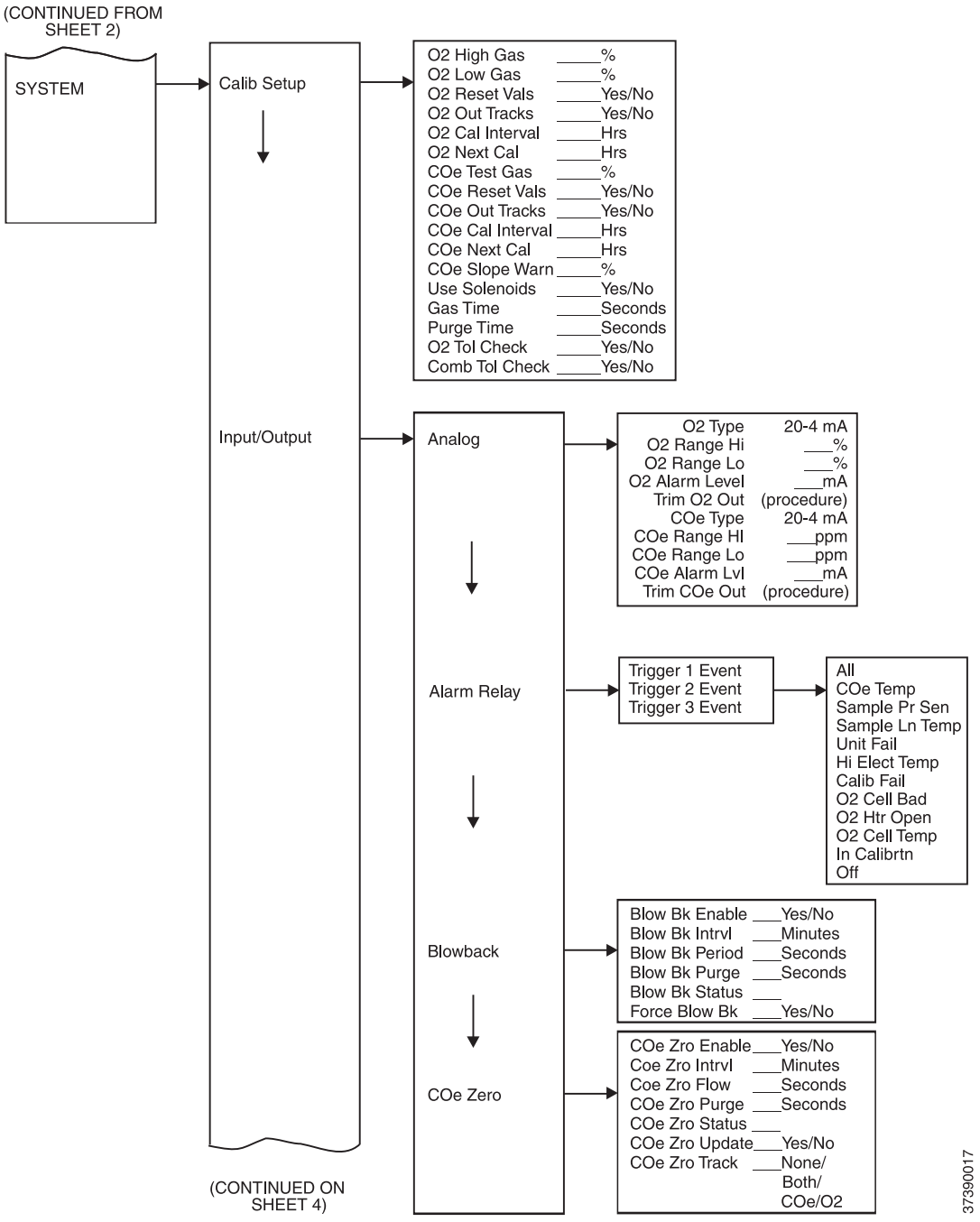
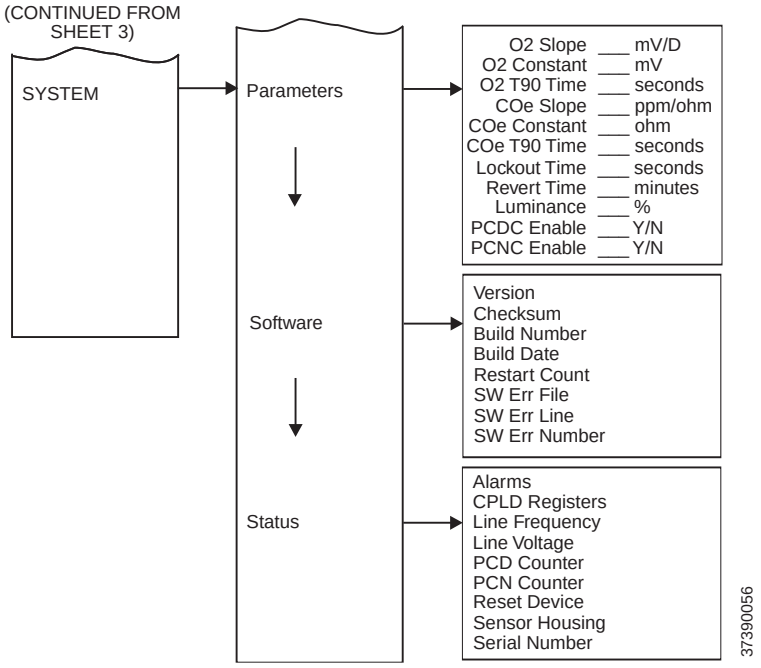


Figure 4-4. LOI Menu Tree
(Sheet 4 of 4)



Section 5 Calibration

Overview . . . . . **page 5-1**
Fully Automatic Calibration . . . . . **page 5-1**
Operator - Initiated Autocalibration . . . . . **page 5-3**
Manual Calibration . . . . . **page 5-4**
D/A Trim Procedures - LOI . . . . . **page 5-12**
D/A Trim Procedures - HART . . . . . **page 5-14**

OVERVIEW

During a calibration, two calibration gases with known O_2 concentrations and one calibration gas with a known COe concentration are applied to the Hazardous Area OCX 8800. Slope and constant values are calculated to determine if the Hazardous Area OCX 8800 is correctly measuring net concentrations of O_2 and combustibles in the industrial process.

Before calibrating the Hazardous Area OCX 8800, verify that the calibration gas parameters are correct by setting the test gas values used when calibrating the unit. Refer to Section 3, Configuration and Startup.

There are three calibration methods available to the Hazardous Area OCX 8800; automatic, operator-initiated automatic, and manual. Calibration commands and menus can be accessed by 375 Field Communicator or by the optional LOI.

FULLY AUTOMATIC CALIBRATION

If the Hazardous Area OCX 8800 is equipped with calibration solenoids, the unit can be programmed to automatically calibrate without any operator action. Refer to the following paragraphs for using the LOI or 375 Field Communicator to set up the OCX 8800 for fully automatic calibration.

Autocalibration Setup using the optional LOI

Use the following procedure to set up the Hazardous Area OCX 8800 for automatic calibration. If necessary, use the LOI menu tree in Figure 4-4 for reference. The unit must be equipped with calibration solenoids to use automatic calibration.

NOTE
Automatic calibration is only available on units equipped with calibration solenoids.

1. From the operating display use the right-pointing key to select **SYSTEM** first column submenu.
2. From the **SYSTEM** first column submenu, use the right-pointing key to select the **Calib Setup** second column submenu.

3. From the **Calib Setup** second column submenu, use the right-pointing key to select the third column parameter list.
4. Scroll down to the last item **Use Solenoids**. If the unit is equipped with calibration solenoids and timed automatic calibration is desired, select **Yes**.
5. Use the up-pointing key to select the item **O2 Out Tracks**. Select **Yes** or **No** to determine if updates to the O_2 lock value will take place.
6. Use the down-pointing key to select the item **COe Out Tracks**. Select **Yes** or **No** to define if updates to the COe lock value will take place.
7. Use the down-pointing key to select the item **O2 Cal Interval**. Enter the amount of time in days and hours that is desired between automatic calibrations.
8. Use the down-pointing key to select the next item **O2 Next Cal**. Enter the amount of time in hours until the next automatic calibration. Select the left-pointing key three times to move back to the LOI operating display.

Autocalibration Setup using the Field Communicator - HART

NOTE
Automatic calibration is only available on units equipped with calibration solenoids.

Use the following procedure to specify a time interval (in hours) at which the Hazardous Area OCX 8800 will automatically calibrate.

1. From the **DEVICE SETUP** screen, select **DETAILED SETUP**.
2. From the **DETAILED SETUP** screen, select **CAL SETUP**, then select **O2 CAL PARAMS** or **COE CAL PARAMS**.
3. If the unit is equipped with calibration solenoids and timed automatic calibrations are desired, select **Solenoids**, then select **Y**es. Select **N**o to disable the calibration solenoids.
4. Select **O2 Cal Intrvl** (O_2 calibration interval) and enter the desired time in hours between automatic O_2 calibrations. Select **COE Cal Intrvl** and enter the desired time between automatic COe calibrations. To disable automatic calibration for O_2 and COe, enter 0 for both **Cal Intrvl** parameters.
5. If desired, the **O2 Next Cal Time** and the **COe Next Cal Time** (next calibration time) parameters can be changed to synchronize a calibration at a specific day or time.

⚠CAUTION

When setting automatic calibration times, CalIntrvl and NxtCalTm should be set so that O_2 and COe are NOT calibrated simultaneously.

NOTE
To select a menu item, either use the up and down arrow keys to scroll to the menu item and press the right arrow key or use the number keypad to select the menu item number.

To return to a preceding menu, press the left arrow key.

Autocalibration Setup using the Field Communicator - Fieldbus

NOTE
Automatic calibration is only available on units equipped with calibration solenoids.

Use the following procedure to specify a time interval (in hours) at which the Hazardous Area OCX 8800 will automatically calibrate.

1. From the **Transducer** screen select **O2 Cal** or **COe Cal**.
2. From the **O2 Cal** or **COe Cal** screen, select **O2 Cal Setup** or **COe Setup**.
3. If the unit is equipped with calibration solenoids and timed automatic calibration are desired, select **Solenoids**, then select **Yes**. Select **No** to disable the calibration solenoids.
4. Select **O2 Cal Interval** and/or **COe Cal Interval** and enter the desired time in hours between automatic calibrations. To disable automatic calibration for O2 and COe, enter 0 for both **Cal Interval** parameters.
5. If desired, the **O2 Next Cal** and **CO2 Next Cal** (next calibration time) parameters can be changed to synchronize a calibration at a specific day or time.

OPERATOR - INITIATED AUTOCALIBRATION

An operator can initiate an automatic calibration at any time provided that the unit is equipped with calibration solenoids.

Autocalibration using the optional LOI

To initiate a calibration using the LOI, perform the following steps on the LOI menu tree. Refer to Section 4, Using the LOI, for the LOI menu tree.

1. From the **CALIBRATION** menu, use the right-pointing arrow to select the **Cal Control** menu.
2. Select **Start Cal-O2**, **Start Cal COe**, or **Start Cal Both** to start the calibration. Select **Cal Verify** to access the calibration window.
3. At the prompt, use the right-pointing arrow to initiate automatic calibration.

Autocalibration using the Field Communicator - HART

To initiate an automatic calibration using 375 Field Communicator, perform the following steps. Refer to Section 6, Field Communicator, for the HART menu tree.

1. Select **DIAG/SERVICE** from **DEVICE SETUP** menu.
2. Select **CALIBRATION** from the **DIAG/SERVICE** menu.
3. Select **CAL CONTROL** from the **CALIBRATION** menu.
4. Select **CAL METHODS** from the **CAL CONTROL** menu.
5. From the **CAL METHODS** menu, select the type of calibration desired:

   O2 Calibration,
   COe Calibration, or
   O2 and COe Calibration.

Autocalibration using the Field Communicator - Fieldbus

To initiate an automatic calibration using 375 Field Communicator, perform the following steps. Refer to Section 6, Field Communicator, for the FOUNDATION Fieldbus menu tree.

1. From **Transducer** screen select **Methods**.
2. Select **OCX Calibration** from the **Methods** menu.
3. From the **OCX Calibration** menu, select the type of calibration desired:

   Calibrate O2 Sensor,
   Calibrate Combustibles Sensor, or
   Calibrate Both Sensors.

MANUAL CALIBRATION

If a unit is not equipped with calibration solenoids, a calibration must be performed by an operator following prompts from the unit. Refer to the following paragraphs for manual calibration.

Manual Calibration using the optional LOI

Use the following procedure to perform a manual calibration with the LOI. If necessary, refer to the menu tree in Section 4, Using the LOI. Once the manual calibration procedure is initiated at the LOI, a series of prompts will appear giving instructions to the operator.

1. Use the right-pointing key to select the **CALIBRATION** first column submenu.
2. From the **CALIBRATION** submenu use the right-pointing key to select the **Cal Control** second column submenu.
3. From the **Cal Control** submenu use the right-pointing key to select the third column **Start Cal O2** option.
4. Remain at the **Start Cal O2** option or use the down-pointing key to select the **Start Cal COe** option or **Start Cal Both** option. (The following sequence applies when **Start Cal Both** is selected.)
5. Use the right-pointing key to start the calibration. Turn on the low O_2 test gas, when prompted by the **Flow Low Gas** message.
6. Press the right-pointing key when the low O_2 test gas is applied. The calibration data changes as the calibration proceeds.
7. Press the right-pointing key when the low O_2 reading is stable. Turn off the low O_2 test gas and turn on the high O_2 test gas as prompted by the **Flow High Gas** message.
8. Press the right-pointing key when the high O_2 test gas is applied. The calibration data changes as the calibration proceeds.

9. Press the right-pointing key when the high O_2 reading is stable. Turn off the high O_2 test gas. Press the right-pointing key to start the high O_2 gas purge.
10. When the purge period expires, the LOI display reverts to the normal operation display. If the calibration failed, the display will indicate an alarm condition.
11. Press the right-pointing key to start combustibles calibration. Turn on the CO test gas when prompted.
12. Press the right-pointing key when the CO test gas is applied. The calibration data changes as the calibration proceeds.
13. Press the right-pointing key when the CO reading is stable.
14. Turn off the CO test gas and press the right-pointing key to start the CO gas purge.
15. When the purge period expires, the LOI display reverts to the normal operation display. If the calibration failed, the display will indicate an alarm condition.

Manual O_2 Calibration using the Field Communicator - HART

To perform a manual O_2 calibration using the 375 Field Communicator, use the following procedure. If necessary, refer to Section 6, Field Communicator, for the HART menu tree.

NOTE
To select a menu item, either use the up and down arrow keys to scroll to the menu item and press the right arrow key or use the number keypad to select the menu item number.

To return to a preceding menu, press the left arrow key.

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1. Select **DIAG/SERVICE** from **DEVICE SETUP** menu.
2. Select **CALIBRATION** from the **DIAG/SERVICE** menu.
3. Select **CAL CONTROL** from the **CALIBRATION** menu.
4. Select **CAL METHODS** from the **CAL CONTROL** menu.
5. From the **CAL METHODS** menu, select the type of calibration desired:

   O2 Calibration
6. In the first Calibration screen, a Loop should be removed from automatic control warning appears. Remove the Hazardous Area OCX 8800 from any automatic control loops to avoid a potentially dangerous operating condition and press OK.
7. The Calibration screen should look like the following. Press **OK** to continue.

   OCX: TAG NAME
   STEP: Idle
   TIME REMAIN: 0s
   O2: 0.4 %
   O2 Snsr: 85.95mV
   OK/NEXT to Select
   ABORT/CANCEL to Exit

8. From the **SELECT ACTION** screen, select **START CAL/STEP CAL** to continue calibration, select **ABORT CAL** to abort calibration or **EXIT CAL** to exit calibration. Select one item from the list and press **ENTER**.
   OCX: TAG NAME
   SELECT ACTION
   1. START CAL/STEP CAL
   2. ABORT CAL
   3. EXIT CAL
9. When the Calibration Status is at the **AppO2Low** step, switch on O_2 Low Gas. Verify the O_2 concentration measured matches the **O2 LOW GAS** parameter in the Setup. Press **OK** when ready.
10. Select **START CAL/STEP CAL** to start applying the O_2 Low Gas. The time to apply the test gas is specified by the **Gas Time**.
11. The Calibration Status should be automatically changed to **FlowO2Low** and then **ReadO2Low** for a period of time. During this period, if an attempt is made to go to the next calibration step by pressing **OK** and selecting **START CAL/STEP CAL**, you will be prompted with **Operator step command is not accepted at this time**.
12. When ready, Calibration Status will stop at the **AppO2Hi**. Switch off the O_2 Low Gas and switch on the O_2 High Gas. Verify the O_2 concentration measured matches the **O2 HIGH GAS** parameter in the Setup. Press **OK** when ready.
13. Select **START CAL/STEP CAL** to start applying the O_2 High Gas. The time to apply the test gas is specified by the **Gas Time**.
14. The Calibration Status should be automatically changed to **FlowO2Hi** and then **ReadO2Hi** for a period of time. During this period, if an attempt is made to go the next calibration step by pressing **OK** and selecting **START CAL/STEP CAL**, you will be prompted with **Operator step command is not accepted at this time**.
15. When ready, Calibration Status will stop at **STOP GAS**. Switch off the O_2 High Gas. Press **OK** when ready. Select **START CAL/STEP CAL** to start purging gas. The time to purge gas is specified by the **Purge Time**.
16. When the **Purge** step is complete, the Calibration Status will be at **IDLE**. A Calibration Failed alarm will be set if the calibration has failed.
17. When calibration is complete. Select **Exit Cal** to exit the calibration method.

Manual COe Calibration using the Field Communicator - HART

To perform a manual COe calibration using the 375 Field Communicator, use the following procedure. If necessary, refer to Section 6, Field Communicator, for the HART menu tree.

NOTE
To select a menu item, either use the up and down arrow keys to scroll to the menu item and press the right arrow key or use the number keypad to select the menu item number.

To return to a preceding menu, press the left arrow key.

1. Select **DIAG/SERVICE** from **DEVICE SETUP** menu.
2. Select **CALIBRATION** from the **DIAG/SERVICE** menu.
3. Select **CAL CONTROL** from the **CALIBRATION** menu.
4. Select **CAL METHODS** from the **CAL CONTROL** menu.
5. From the **CAL METHODS** menu, select the type of calibration desired:

   COe Calibration, or

6. In the first Calibration screen, **a loop should be removed from automatic control** warning appears. Remove the Hazardous Area OCX 8800 from any automatic control loops to avoid a potantially dangerous operating condition and press **OK**.
7. The main Calibration screen should look like the following. Press **OK** to continue.

   OCX: TAG NAME
   STEP: Idle
   TIME REMAIN: 0s
   COe: 0.20 ppm
   COe DELTA R: 0.00 ohm
   OK/NEXT to Select
   ABORT/CANCEL to Exit

8. From the **SELECT ACTION** screen, select **START CAL/STEP CAL** to continue calibration, select **ABORT CAL** to abort calibration or **EXIT CAL** to exit calibration. Select one item from the list and press **ENTER**.

   OCX: TAG NAME
   SELECT ACTION
   1. START CAL/STEP CAL
   2. ABORT CAL
   3. EXIT CAL

9. The unit samples O_2 High Gas as the COe Low Gas. The Calinration Status should automatically change to **ReadCOLow** for a period of time. During this period, if an attempt is made to go to the next calibration step by pressing **OK** and selecting **START CAL/STEP CAL**, you will be prompted with **Operator step command is not accepted at this time.**
10. When ready, Calibration Status will stop at the **AppCOeHi**. Switch on the COe High Gas. Verify the COe concentration measured matches the **COe HIGH GAS** parameter in the Setup. Press **OK** when ready.

11. Select **START CAL/STEP CAL** to start applying the COe High Gas. The time to apply the test gas is specified by the **Gas Time**.
12. The calibration status should automatically change to **FlowCOeHI** and then **ReadCOeHigh** for a period of time. During this period, if an attempt is made to go to the next calibration step by pressing **OK** and selecting **START CAL/STEP CAL**, you will be prompted with **Operator step command is not accepted at this time**.
13. When ready, Calibration Status will stop at **STOP GAS**, switch off the COe High Gas. Press **OK when ready**. Select **START CAL/STEP CAL** to start purging gas. The time to purge gas is specified by the **Purge time**.
14. When the **Purge** step is complete, the Calibration Status will be at **IDLE**. A Calibration Failed alarm will be set if the calibration has failed.
15. When calibration is complete. Select **Exit Cal** to exit the calibration method.

Manual O_2 and COe Calibration using the Field Communicator - HART

To perform a manual O_2 and COe calibration using the Field Communicator or AMS, use the following procedure. If necessary, refer to Section 6, Field Communicator, for the HART menu tree.

NOTE
To select a menu item, either use the up and down arrow keys to scroll to the menu item and press the right arrow key or use the number keypad to select the menu item number.

To return to a preceding menu, press the left arrow key.

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1. Select **DIAG/SERVICE** from **DEVICE SETUP** menu.
2. Select **CALIBRATION** from the **DIAG/SERVICE** menu.
3. Select **CAL CONTROL** from the **CALIBRATION** menu.
4. Select **CAL METHODS** from the **CAL CONTROL** menu.
5. From the **CAL METHODS** menu, select the type of calibration desired:

   O2 and COe Calibration.
6. In the first Calibration screen, a **Loop should be removed from automatic control** warning appears. Remove the Hazardous Area OCX 8800 from any automatic control loops to avoid a potentially dangerous operating condition and press **OK**.
7. The main Calibration screen should look like the following. Press **OK** to continue.

   OCX: TAG NAME
   STEP: Idle
   TIME REMAIN: 0s
   O2: 0.4 %, 85.95mV
   COe: 0.20 ppm
   OK/NEXT to Select
   ABORT/CANCEL to Exit

8. From the **SELECT ACTION** screen, select **START CAL/STEP CAL** to continue calibration, select **ABORT CAL** to abort calibration or **EXIT CAL** to exit calibration method. Select one from the list and press **ENTER**.

   OCX: TAG NAME
   SELECT ACTION
   1. START CAL/STEP CAL
   2. ABORT CAL
   3. EXIT CAL

9. When the Calibration Status is at the **AppO2Low** step, switch on O_2 Low Gas. Verify the O_2 concentration measured matches the **O2 LOW GAS** parameter in **Setup CAL**. Press **OK** when ready.
10. Select **START CAL/STEP** to start applying the O_2 Low Gas. The time to apply the test gas is specified by the **Gas Time**.
11. The Calibration Status should automatically change to **FlowO2Low** and then **ReadO2Low** for a period of time. During this period, if an attempt is made to go to the next calibration step by pressing **OK** and selecting **START CAL/STEP CAL**, you will be prompted with **Operator step command is not accepted at this time**.
12. When ready, Calibration Status will stop at **AppO2Hi**. Switch off the O_2 Low Gas and switch on the O_2 High Gas. Verify the O_2 concentration measured matches the **O2 HIGH GAS** parameter in **Setup**. Press **OK** when ready.
13. Select **START CAL/STEP CAL** to apply the O_2 High Gas. The time to apply the test gas is specified by the **Gas Time**.
14. The Calibration Status should automatically change to **FlowO2Hi**, then **ReadO2Hi**, and then **ReadCOeLo** for a period of time. During this period, if an attempt is made to go the next calibration step by pressing **OK** and selecting **START CAL/STEP CAL**, you will be prompted with **Operator step command is not accepted at this time**.
15. When ready, Calibration Status will stop at **AppCOeHi**. Switch off the O_2 High Gas and switch on the COe Gas. Verify the COe concentration measured matches the **COe TEST GAS** parameter in the **Setup**. Press **OK** when ready.
16. Select **START CAL/STEP CAL** to start applying the COe Gas. The time to apply the test gas is specified by the **Gas Time**.
17. The Calibration Status should automatically change to **FlowCOeHi** and then **ReadCOeHi** for a period of time. During this period, if an attempt is made to go the next calibration step by pressing **OK** and selecting **START CAL/STEP CAL**, you will be prompted with **Operator step command is not accepted at this time**. The **Next Cal Step** command is not accepted at this time.

When ready, Calibration Status will stop at **STOP GAS**. Switch off the COe gas. Press **OK** when ready. Select **START CAL/STEP CAL** to start purging gas. The time to purge gas is specified by **Purge Time**.

Manual O_2/COe Calibration using the Field Communicator - Fieldbus

To perform a manual O_2/COe calibration using the 375 Field Communicator, use the following procedure. If necessary, refer to Section 6, Field Communicator, for the Fieldbus menu tree.

NOTE
To select a menu item, either use the up and down arrow keys to scroll to the menu item and press the right arrow key or use the number keypad to select the menu item number.

To return to a preceding menu, press the left arrow key.

1. To calibrate from Fieldbus, the first step is to set the Transducer Block to Out of Service Mode (OOS).
2. To set the OOS mode, select **Transducer** then select **Process**, followed by select **Out of Service** in the **Target Mode**.
3. From **Transducer** screen select **Methods**.
4. Select **OCX Calibration** from the **Methods** menu.
5. From the **OCX Calibration** screen, select **Calibrate O2 Sensor** for O2 calibration, select **Calibrate Combustibles Sensor** for COe calibration, or select **Calibrate Both Sensors** if calibrate both sensors is desired.
6. In the calibration screen, a **Loop should be removed from automatic control** warning appears. Remove the device from any automatic control loops to avoid a potentially dangerous operating condition and press **OK**.
7. The **Select Action** screen should look like the following. From the Select Action screen, select **Update Display** to refresh the calibration status, select **Next Calibration Step** to continue calibration, select **Abort Calibration** to abort calibration or **Exit** to exit calibration. Select one item from the list and press **OK**. The Select Action screen is static and data will not be automatically refreshed.

   Calibration Step = Idle
   Step Time Remaining = 0 seconds
   O2 Value = 0.40 %
   Combustibles Value = 1000 ppm

   1. Update Display
   2. Next Calibration Step
   3. Abort Calibration
   4. Exit

8. The **Calibration Screen** should look like the following, press **OK** to continue. The **Calibration Screen** should be automatically refreshed, however it may take a while for the data to refresh.

   Calibration Step = Apply O2 Low Gas
   Step Time Remaining = 0 seconds
   O2 Value = 0.40 %
   Combustibles Value = 1000 ppm
   Press Next for Selection

9. When the calibration status is at the **Apply O2 Low Gas/ Apply Comb Low Gas** step, switch on O2 Low Gas/COe Low Gas. Verify the O2 concentration measured matches the **O2 Low Gas** parameter in the setup. The unit samples reference air as the COe Low Gas. Press **OK** when ready.
10. Select **Next Calibration Step** and press **OK** to start applying the test gas. The time to apply the test gas is specified by the **Gas Time**.
11. The calibration step will change to **Flow O2 Low Gas/ Flow Comb Low Gas** and then **Read O2 Low Gas/ Read Comb Low Gas** for a period of time.
12. When ready, Calibration Step will stop at the **Apply O2 High Gas/ Apply Comb High Gas**. Switch off the O2 Low Gas/Sample Reference Air and switch on the O2 High Gas/Comb Test Gas. Verify the O2/COe concentration measured matches the **O2 High Gas/COe Test Gas** parameter in the setup. Press **OK** when ready.
13. Select **Next Calibration Step** to start applying the test gas. The time to apply the test gas is specified by the **Gas Time**.
14. The calibration step will change to **Flow O2 High Gas/ Flow Comb High Gas** and then **Read O2 High Gas/ Read Comb High Gas** for a period of time.
15. Skip over to Step 19, **Stop Gas**, if executing **Calibrate O2 Sensor** or **Calibrate Combustibles Sensor**.
16. The calibration step will change to **Read Comb Low Gas** for a period of time. When ready, Calibration Step will stop at **Apply Comb High Gas**. Switch off the O2 High Gas and switch on the COe Test Gas. Verify the COe concentration measured matches the **COe Test Gas** parameter in the setup.
17. Select **Next Calibration Step** to start applying the test gas. The time to apply the test gas is specified by the **Gas Time**.
18. The calibration step will change to **Flow Comb High Gas** and then **Read Comb High Gas** for a period of time.
19. When ready, Calibration step will stop at **Stop Gas**. Switch off the O2 High Gas/COe Test Gas, Press **OK** when ready. Select Next Calibration Step to start purging gas. The time to purge gas is specified by the **Purge Time**.
20. When the **Purge** step is complete, the Calibration Step will be at **Idle**. The Calibration Failed alarm will be set if the calibration has failed.
21. When calibration is complete. Select **Exit** to exit the calibration method.

D/A TRIM PROCEDURES - LOI

O_2 D/A trim procedure using the LOI

Use the following procedure to perform the O_2 D/A trim procedure at the LOI. Refer to the LOI menu tree in Figure 4-4.

⚠WARNING

To avoid a potentially dangerous operating condition, the Hazardous Area OCX 8800 must be removed from the automatic combustion control loop before you start the D/A trim procedure.

1. From the operating display use the left-pointing key to select the first column submenu. Use the down-pointing key to select **SYSTEM**.
2. From the **SYSTEM** menu, use the down-pointing key to select **Input/Output**. Use the right-pointing key to select the **Analog** parameters list.
3. Scroll down to the item **Trim O2 Out**. Touch the right-pointing key to start the O_2 trim procedure.

NOTE
If you wish to exit D/A Trim with no changes, step through the procedure using **y**es responses, and enter no meter readings.

4. Remove the electronics housing cover.
5. Refer to Figure 2-6. Connect a digital multimeter to read the milliamp output from the O_2 D/A converter circuit. Connect the positive lead to the AOUT1+ terminal and connect the negative lead to the AOUT1- terminal. Then, touch the **Enter** key at the LOI.
6. The LOI displays **4 mA.....Meter**. The trim program inputs the design-equivalent signal for a 4.00 mA output. Read the O_2 millamp output at the digital multimeter. Use the right-pointing key to select each digit and use the up- and down-pointing keys to change the value. When the correct value is displayed, use the **Enter** key to input the value.
7. The LOI displays **20 mA.....Meter**. The trim program inputs the design-equivalent signal for a 20.00 mA output. Read the O_2 millamp output at the digital multimeter. Use the right-pointing key to select each digit and use the up- and down-pointing keys to change the value. When the correct value is displayed, use the **Enter** key to input the value.
8. The LOI displays a **Meter at 4 mA** prompt. Use the right-pointing key to select the letter **y**es or **n**o. Use the up- or down-pointing key to change the letter. Then use the **Enter** key to input the response. If **n**o, the process repeats from step 7.
9. The LOI displays a **Meter at 20 mA** prompt. Use the right-pointing key to select the letter **y**es or **n**o. Use the up- or down-pointing key to change the letter. Then use the **Enter** key to input the response. If **n**o, the process repeats from step 8.
10. When the ropiness in steps 9 and 10 are **y**es, the trim procedure is complete. Exit the LOI menu and return the control loop to automatic control.

COe D/A trim procedure using the LOI

Use the following procedure to perform the COe D/A trim procedure at the LOI. Refer to the LOI menu tree in Figure 4-4.

⚠WARNING

To avoid a potentially dangerous operating condition, the Hazardous Area OCX 8800 must be removed from the automatic combustion control loop before you start the D/A trim procedure.

1. From the operating display use the left-pointing key to select the first column submenu. Use the down-pointing key to select **SYSTEM**.
2. From the **SYSTEM** menu, use the down-pointing key to select **Input/Output**. Use the right-pointing key to select the **Analog** parameters list.
3. Scroll down to the item **Trim COe Out**. Touch the right-pointing key to start the COe trim procedure.

NOTE
If you wish to exit D/A Trim with no changes, step through the procedure using **y**es responses, and enter no meter readings.

4. Remove the electronics housing cover.
5. Refer to Figure 2-6. Connect a digital multimeter to read the milliamp output from the COe D/A converter circuit. Connect the positive lead to the AOUT2+ terminal and connect the negative lead to the AOUT2- terminal. Then, touch the **Enter** key at the LOI.
6. The LOI displays **4 mA.....Meter**. The trim program inputs the design-equivalent signal for a 4.00 mA output. Read the COe millamp output at the digital multimeter. Use the right-pointing key to select each digit and use the up- and down-pointing keys to change the value. When the correct value is displayed, use the **Enter** key to input the value.
7. The LOI displays **20 mA.....Meter**. The trim program inputs the design-equivalent signal for a 20.00 mA output. Read the COe millamp output at the digital multimeter. Use the right-pointing key to select each digit and use the up- and down-pointing keys to change the value. When the correct value is displayed, use the **Enter** key to input the value.
8. The LOI displays a **Meter at 4 mA** prompt (question). Use the right-pointing key to select the letter **y**es or **n**o. Use the up- or down-pointing key to change the letter. Then use the **Enter** key to input the response. If **n**o, the process repeats from step 7.
9. The LOI displays a **Meter at 20 mA** prompt (question). Use the right-pointing key to select the letter **y**es or **n**o. Use the up- or down-pointing key to change the letter. Then use the **Enter** key to input the response. If **n**o, the process repeats from step 8.
10. When the ropiness in steps 9 and 10 are **y**es, the trim procedure is complete. Exit the LOI menu and return the control loop to automatic control.

D/A TRIM PROCEDURES - HART

O_2 D/A trim procedure using HART

Use the following procedure to perform the O_2 D/A trim procedure using the Field Communicator. If necessary, refer to Section 6, Field Communicator, for the HART menu tree.

NOTE
To select a menu item, either use the up and down arrow keys to scroll to the menu item and press the right arrow key or use the number keypad to select the menu item number.

To return to a preceding menu, press the left arrow key.

1. From the **DIAG/SERVICE** menu, select **D/A TRIM**. Select **O2 D/A Trim**.
2. Press the right arrow key to start the procedure. (If you wish to exit D/A Trim with no changes, select **ABORT**.)
3. The Field Communicator displays **WARNING: Loop should be removed from automatic control**. Remove the Hazardous Area OCX 8800 from any automatic control loops to avoid a potentially dangerous operating condition and press **OK**.
4. The Field Communicator displays **Connect reference meter to O2 output**.
5. Remove the electronics housing cover.
6. Refer to Figure 2-6. Connect a digital multimeter to read the milliamp output from the O_2 D/A converter circuit. Connect the positive lead to the AOUT1+ terminal and connect the negative lead to the AOUT1- terminal. Then, press **OK** at the Field Communicator.
7. The Field Communicator displays **Setting Fld dev output to 4 mA**. Press **OK**. Read the O_2 millamp output at the digital multimeter. Enter the reading at the Field Communicator and press **ENTER**. (Select **ABORT** to exit without changes).
8. The Field Communicator displays **Setting Fld dev output to 20 mA**. Press **OK**. Read the O_2 millamp output at the digital multimeter. Enter the reading at the Field Communicator and press **ENTER**. (Select **ABORT** to exit without changes).
9. The Field Communicator displays **Setting Fld dev output to 4 mA**. Press **OK**.
10. The Field Communicator displays **Fld dev output 4.00 mA equal to reference meter?** Using the up or down arrow, select **1 Yes** or **2 No** and Press **ENTER**. If **No**, the process repeats from step 6.
11. The Field Communicator displays **Setting Fld dev output to 20 mA**. Press **OK**.
12. The Field Communicator displays **Fld dev output 20.00 mA equal to reference meter?** Using the up or down arrow, select **1 Yes** or **2 No** and Press **ENTER**. If **No**, the process repeats from step 7.
13. The Field Communicator displays **NOTE: Loop may be returned to automatic control**.

COe D/A trim procedure using HART

Use the following procedure to perform the COe D/A trim procedure using the Field Communicator. If necessary, refer to Section 6, Field Communicator, Field Communicator, for the HART menu tree.

NOTE
To select a menu item, either use the up and down arrow keys to scroll to the menu item and press the right arrow key or use the number keypad to select the menu item number.

To return to a preceding menu, press the left arrow key.

1. From the **DIAG/SERVICE** menu, select **D/A TRIM**. Press the up or down arrow to select **COe D/A Trim**.
2. Press the right arrow key to start the procedure. (If you wish to exit D/A Trim with no changes, select **ABORT**.)
3. The Field Communicator displays **WARNING: Loop should be removed from automatic control**. Remove the Hazardous Area OCX 8800 from any automatic control loops to avoid a potentially dangerous operating condition and press **OK**.
4. The Field Communicator displays **Connect reference meter to Combustibles output**.
5. Remove the electronics housing cover.
6. Refer to Figure 2-6. Connect a digital multimeter to read the milliamp output from the COe D/A converter circuit. Connect the positive lead to the AOUT2+ terminal and connect the negative lead to the AOUT2- terminal. Then, press **OK** at the HART communicator.
7. The Field Communicator displays **Setting Fld dev output to 4 mA**. Press **OK**. Read the COe millamp output at the digital multimeter. Enter the reading at the Field Communicator and press **ENTER**. (Select **ABORT** to exit without changes).
8. The Field Communicator displays **Setting Fld dev output to 20 mA**. Press **OK**. Read the COe millamp output at the digital multimeter. Enter the reading at the Field Communicator and press **ENTER**. (Select **ABORT** to exit without changes).
9. The Field Communicator displays **Setting Fld dev output to 4 mA**. Press **OK**.
10. The Field Communicator displays **Fld dev output 4.00 mA equal to reference meter?** Using the up or down arrow, select **1 Yes** or **2 No** and Press **ENTER**. If **No**, the process repeats from step 6.
11. The Field Communicator displays **Setting Fld dev output to 20 mA**. Press **OK**.
12. The Field Communicator displays **Fld dev output 20.00 mA equal to reference meter?** Using the up or down arrow, select **1 Yes** or **2 No** and Press **ENTER**. If **No**, the process repeats from step 7.
13. The Field Communicator displays **NOTE: Loop may be returned to automatic control**.

Section 6 Field Communicator

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Hart Menu Tree . . . . . **page 6-4**
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OVERVIEW

The 375 Field Communicator is a communication interface device. It supports HART and Fieldbus devices letting you configure and troubleshoot in the field.

The 375 Field Communicator includes an LCD with touch-screen display and keypad. Use touch-screen or keypad to enter data into 375 Field Communicator.

Three terminals for the lead set are on the top of the 375 Field Communicator. The lead set and the terminals let you connect the 375 Field Communicator to a device. An access door ensures only one pair of the terminals can be used at any time. Several markings indicate which pair of terminals is for which protocol. The "F" indicates the Fieldbus protocol while "H" indicates the HART protocol.

The infrared port (IrDA) lets the 375 Field Communicator interface with the PC. IrDA is a PC interface supported for transfer of device descriptions (DD), software update, configurations and application licenses. IrDA communication can either be built into the PC or provided through a USB to IrDA adaptor. The PC application can either be AMS Suite or 375 Easy Upgrade Programming Utility. The 375 must be in the "Listen for PC" mode when communicating through IrDA.

Refer to the 375 Field Communicator User Manual for details.

FIELD COMMUNICATOR CONNECTIONS

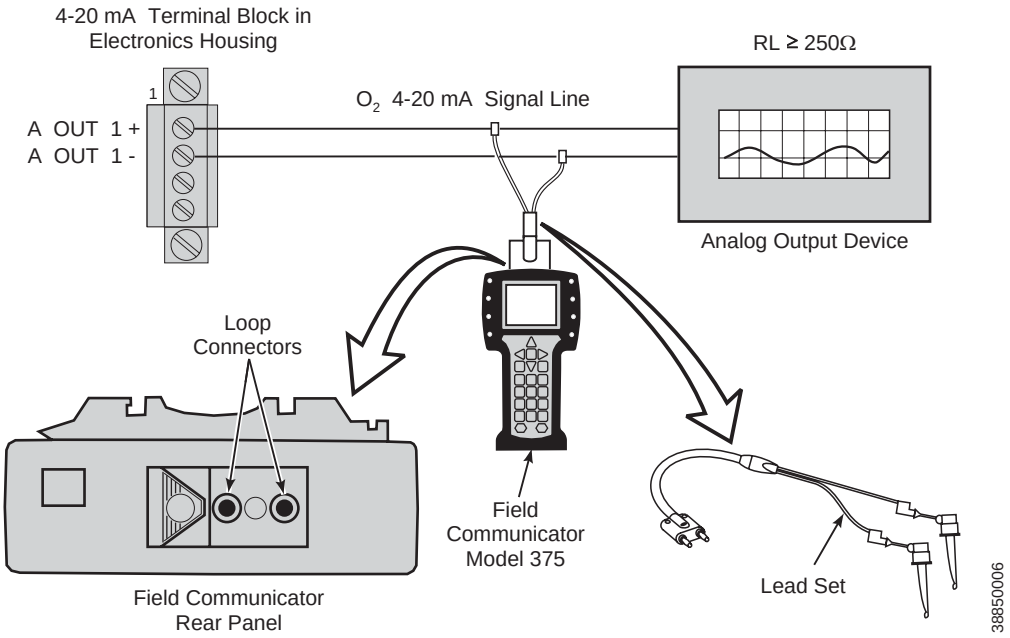
Connecting to a HART loop

Connect 375 Field Communicator with the supplied lead set in parallel with the device or load resistor, Figure 6-1. The HART connections are not polarity sensitive. A minimum 250 ohms resistance must be present in the HART loop for the 375 Field Communicator to function properly.

⚠WARNING

Explosions can result in death or serious injury. Do not make connections to the Field Communicator's serial port, digital signal line, or NiCad recharger jack in an explosive atmosphere.

Figure 6-1. 375 Communicator Connections - HART



Connecting to a Fieldbus Segment

Connect 375 Field Communicator with the supplied lead set in parallel with the device to a Fieldbus segment, Figure 6-2. The 375 Field Communicator Fieldbus connections are polarity sensitive, an error message displays if the device is connected incorrectly.

⚠WARNING

Explosions can result in death or serious injury. Do not make connections to the Field Communicator's serial port, digital signal line, or NiCad recharger jack in an explosive atmosphere.

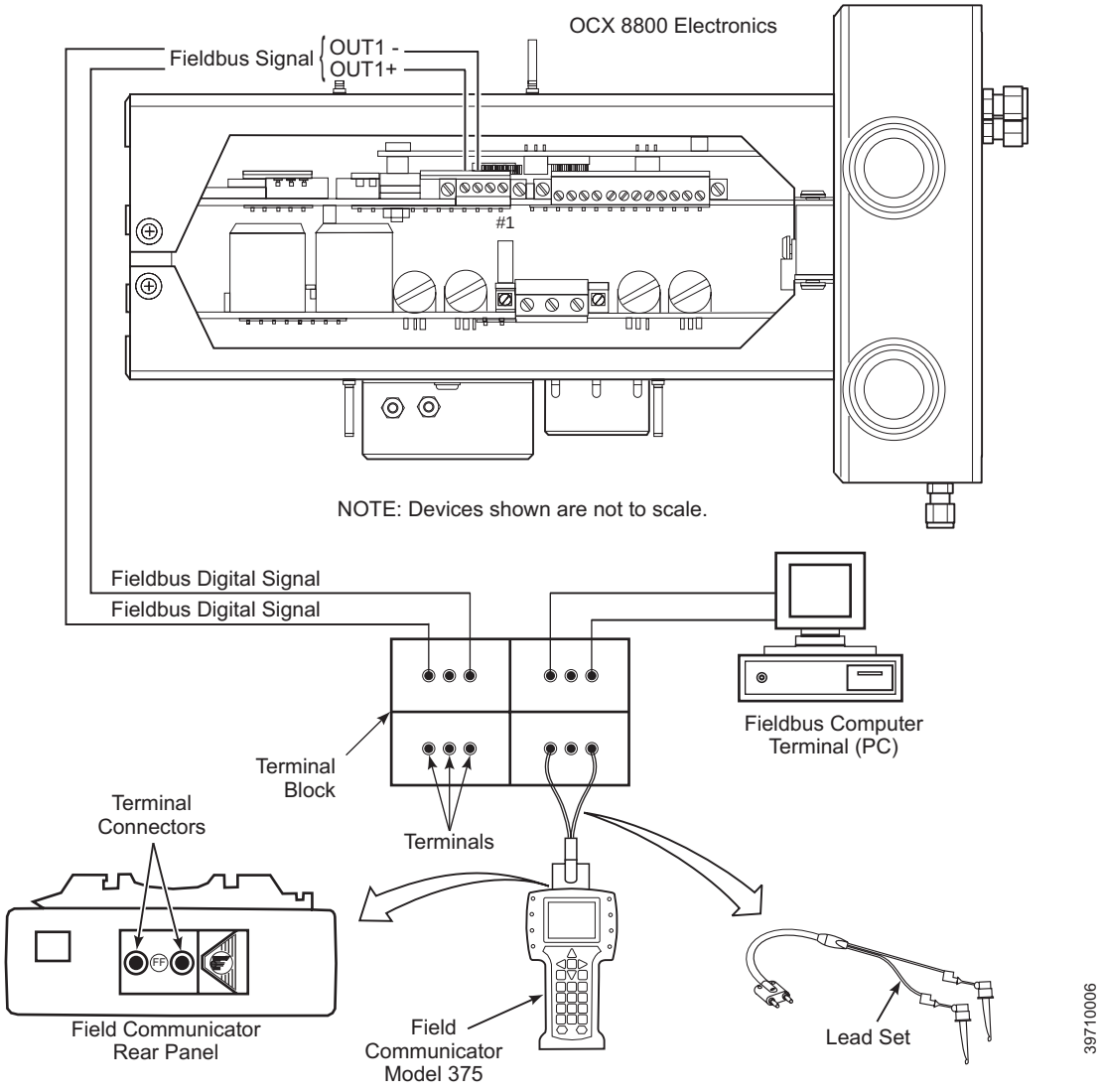
OFF-LINE AND ON-LINE OPERATIONS

The Field Communicator can be operated both off-line and on-line. Off-line operations are those in which the communicator is not connected to the Hazardous Area OCX 8800. Off-line operations can include interfacing the Field Communicator with a PC (refer to applicable Field Communicator documentation regarding Model 375/PC applications). In the on-line mode the communicator is connected to a fieldbus terminal block.

NOTE
If the Field Communicator is turned on while connected to the fieldbus terminal block, an undefined status indication appears while the communicator warms up. Wait until the warm-up period ends to continue.

The opening menu displayed on the LCD is different for on-line and off-line operations. When powering up a disconnected (off-line) communicator the LCD will display the Main Menu. When powering up a connected (on-line) communicator the LCD will display the On-line Menu. Refer to the Field Communicator manual for detailed menu information.

Figure 6-2. 375 Communicator Conections - Fieldbus



HART MENU TREE

This section provides a menu tree for the Field Communicator. This menu is specific to the Hazardous Area OCX 8800 applications.

Figure 6-3. HART Menu Tree (Sheet 1 of 4)

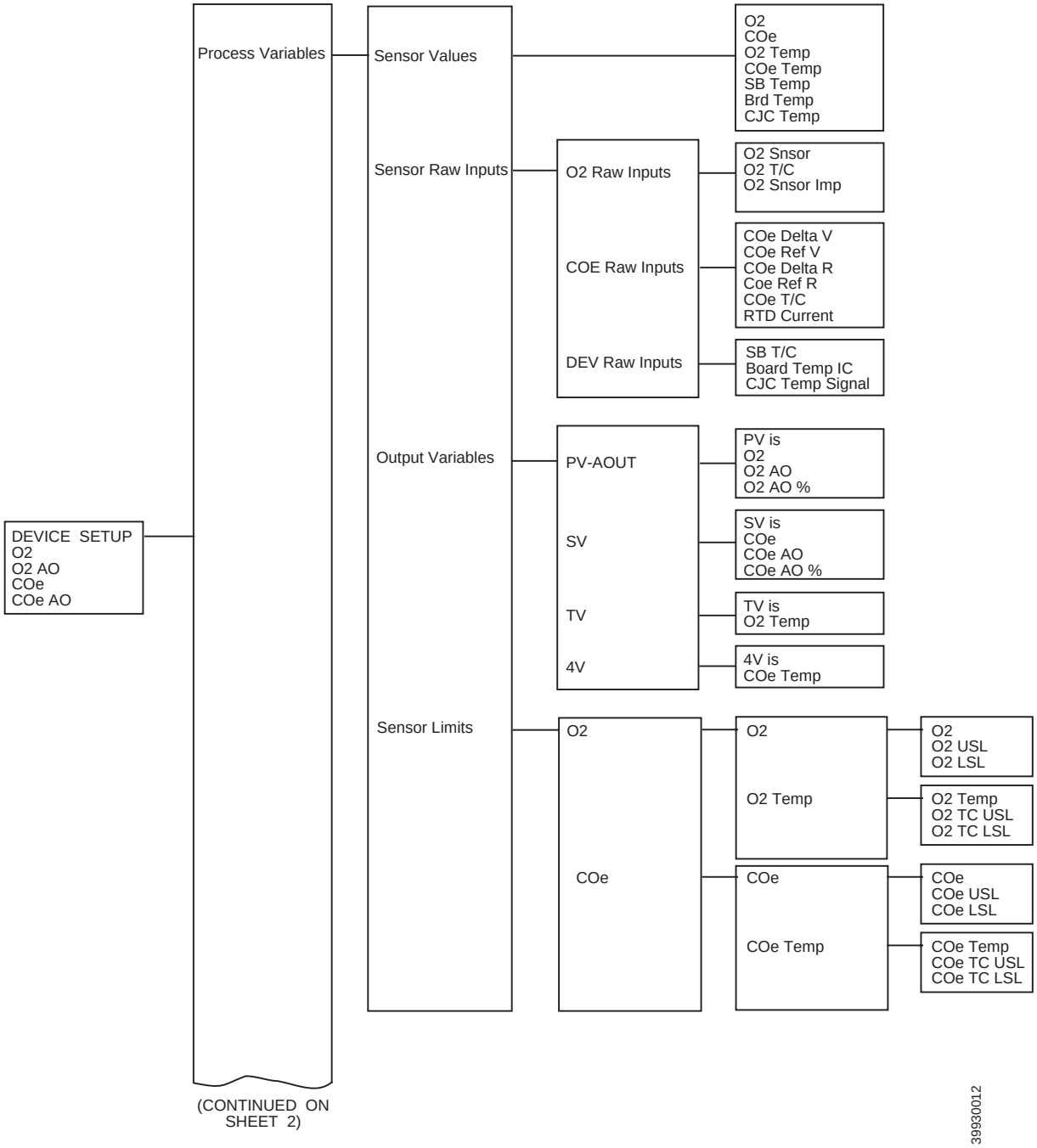


Figure 6-4. HART Menu Tree (Sheet 2 of 4)

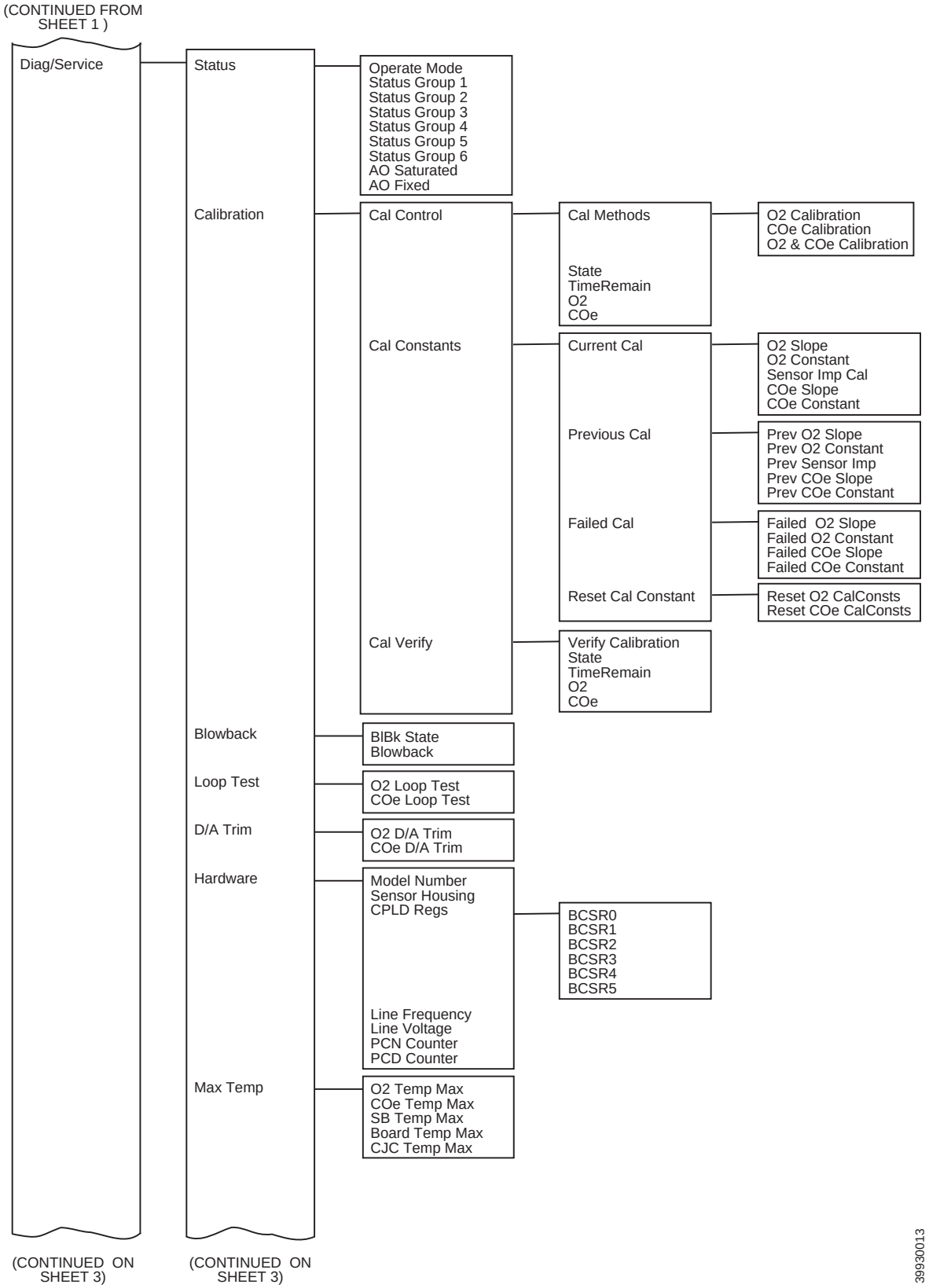


Figure 6-5. HART Menu Tree (Sheet 3 of 4)

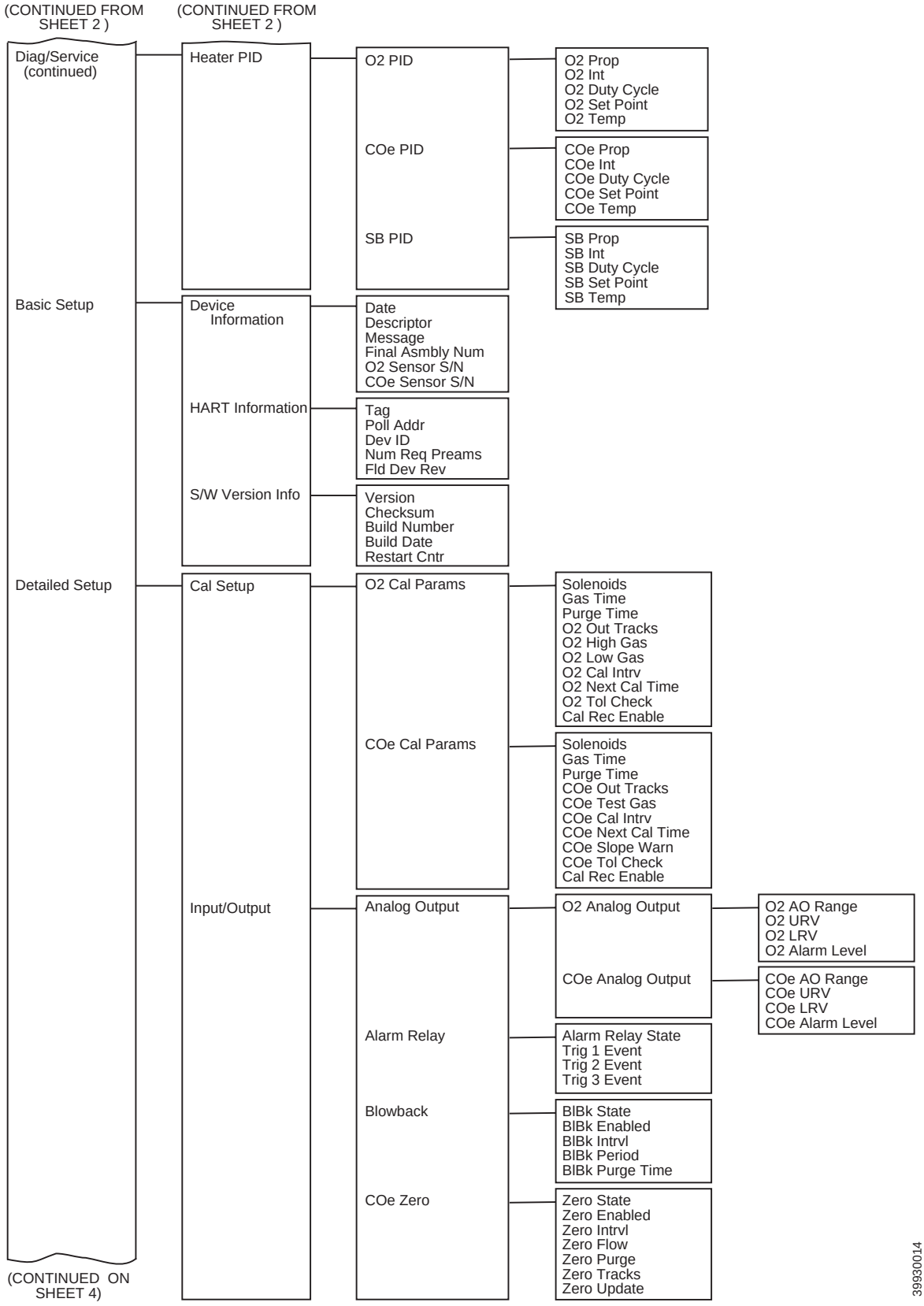
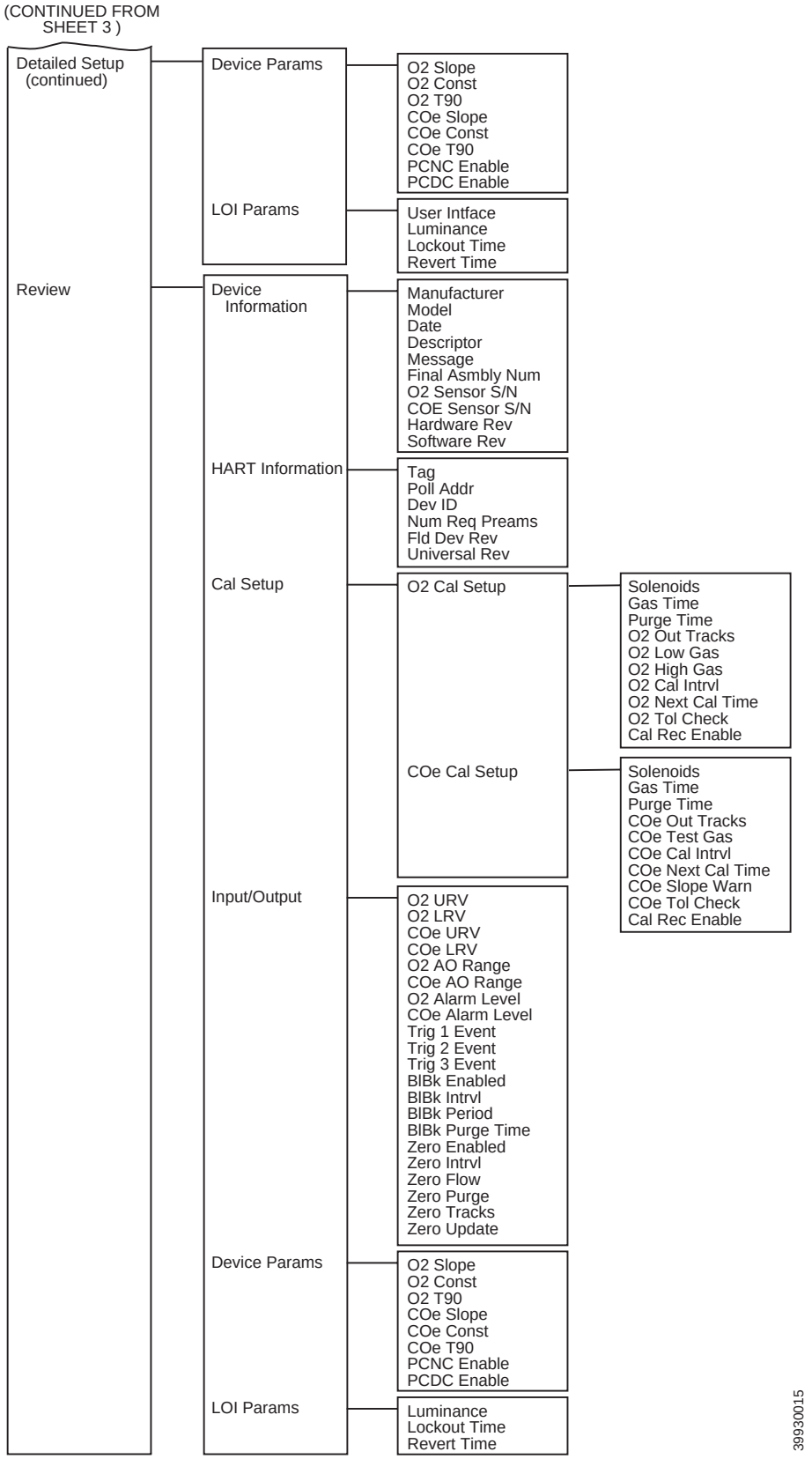


Figure 6-6. HART Menu Tree (Sheet 4 of 4)



FIELDBUS MENU TREE

This section consists of a menu for the Field Communicator. This menu is specific for the Hazardous Area OCX 8800 Applications. Refer to the Fieldbus Parameter Descriptions for the applicable range, units, and description for the fieldbus menu parameters.

Figure 6-7. Fieldbus Menu Tree (Sheet 1 of 3)

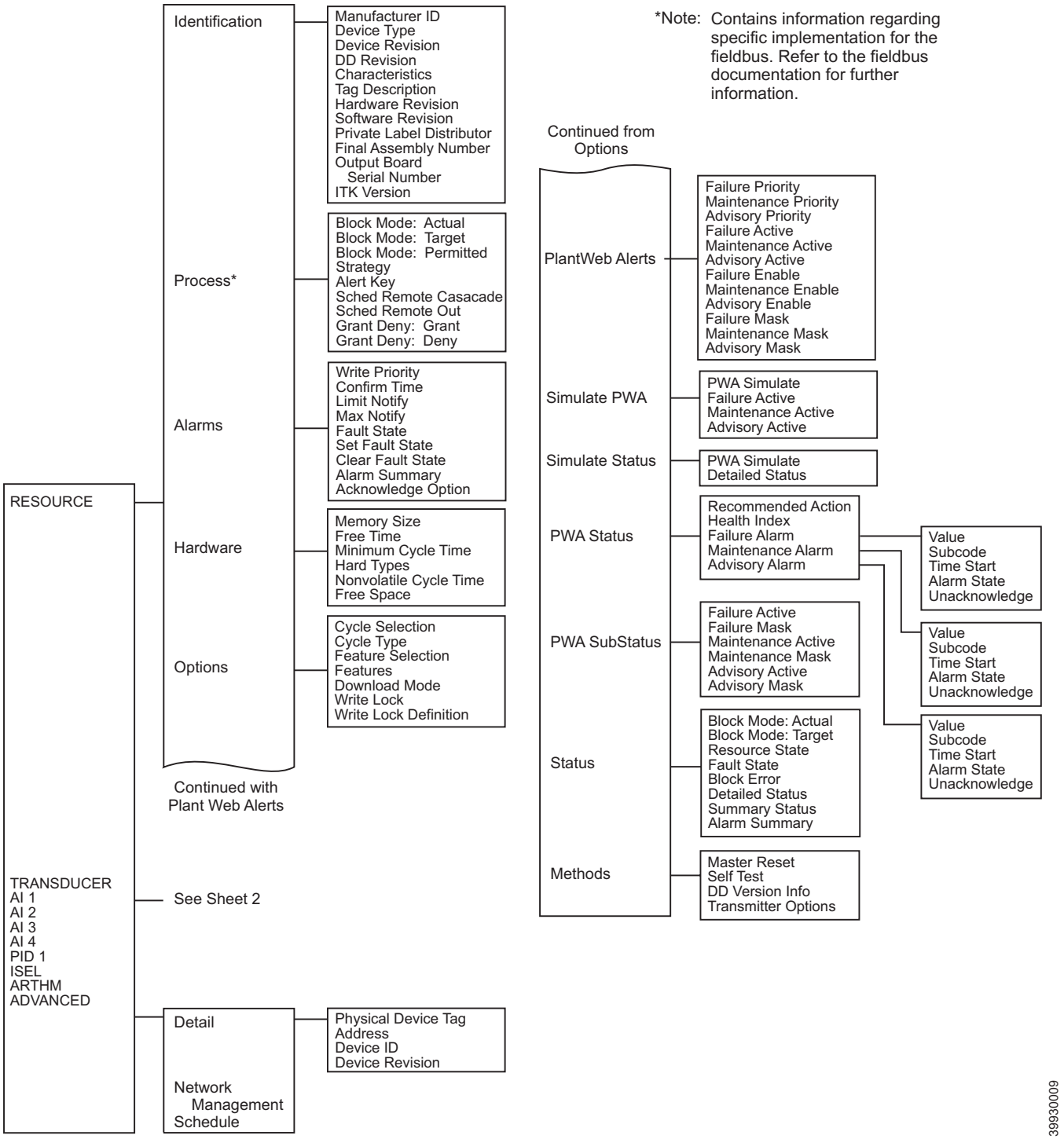


Figure 6-8. Fieldbus Menu Tree (Sheet 2 of 3)

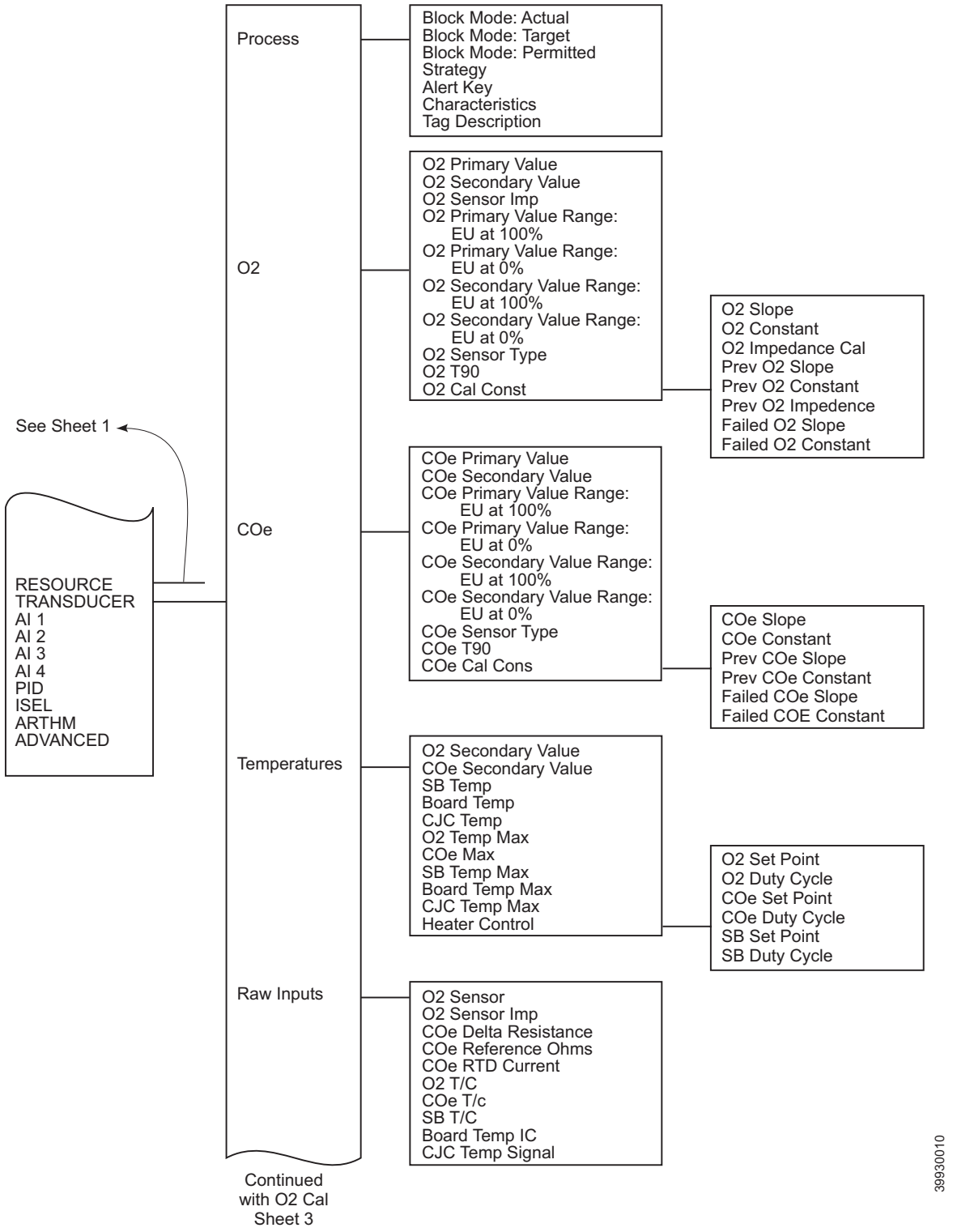
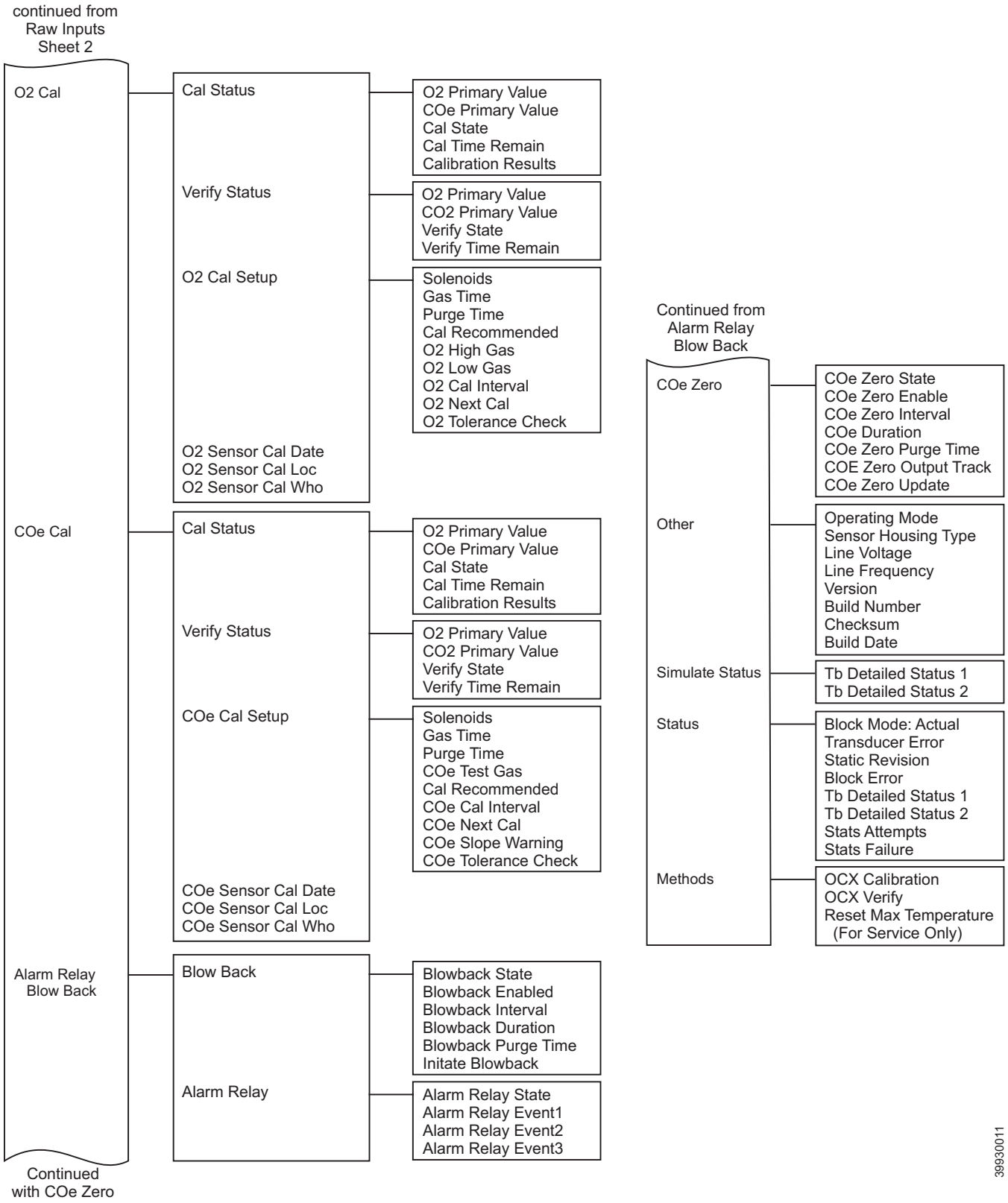


Figure 6-9. Fieldbus Menu Tree (Sheet 3 of 3



Section 7 Foundation Fieldbus

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FOUNDATION FIELDBUS TECHNOLOGY

Overview

FOUNDATION Fieldbus is an all digital, serial, two-way communication system that interconnects field equipment such as sensors, actuators, and controllers. Fieldbus is a Local Area Network (LAN) for instruments used in both process and manufacturing automation with built-in capacity to distribute the control application across the network. It has the ability to distribute control among intelligent field devices on the plant floor and digitally communicate that information at high speed that makes FOUNDATION™ Fieldbus an enabling technology.

EMERSON offers a full range of products from field devices to the DeltaV scalable control system to allow an easy transition to Fieldbus technology.

The Fieldbus retains the features of the 4-20 mA analog system, including standardized physical interface to the wire, bus powered devices on a single wire, and intrinsic safety options, and enables additional capabilities such as:

- Increased capabilities due to full digital communications.
- Reduced wiring and wire terminations due to multiple devices on one set of wires.
- Increased selection of suppliers due to interoperability.
- Reduced loading on control room equipment with the distribution of some control and input/output functions to field devices.
- Speed options for process control and manufacturing applications.

NOTE:
The following descriptions and definitions are not intended as a training guide for FOUNDATION Fieldbus technology but are presented as an overview for those not familiar with Fieldbus and to define device specific attributes for the Fieldbus system engineer. Anyone attempting to implement Fieldbus communications and control with this analyzer must be well versed in Fieldbus technology and protocol and must be competent in programming using available tools such as DeltaV. See “References” below for additional sources for Fieldbus technology and methodology.

Introduction

A Fieldbus system is a distributed system composed of field devices and control and monitoring equipment integrated into the physical environment of a plant or factory. Fieldbus devices work together to provide I/O and control for automated processes and operations. The Fieldbus Foundation provides a framework for describing these systems as a collection of physical devices interconnected by a Fieldbus network. One of the ways that the physical devices are used is to perform their portion of the total system operation by implementing one or more function blocks.

Function Blocks

Function blocks within the Fieldbus device perform the various functions required for process control. Because each system is different, the mix and configuration of functions are different. Therefore, the Fieldbus FOUNDATION has designed a range of function blocks, each addressing a different need.

Function blocks perform process control functions, such as analog input (AI) and analog output (AO) functions as well as proportional-integral-derivative (PID) functions. The standard function blocks provide a common structure for defining function block inputs, outputs, control parameters, events, alarms, and modes, and combining them into a process that can be implemented within a single device or over the Fieldbus network. This simplifies the identification of characteristics that are common to function blocks.

The Fieldbus FOUNDATION has established the function blocks by defining a small set of parameters used in all function blocks called universal parameters. The FOUNDATION has also defined a standard set of function block classes, such as input, output, control, and calculation blocks. Each of these classes also has a small set of parameters established for it. They have also published definitions for transducer blocks commonly used with standard function blocks. Examples include temperature, pressure, level, and flow transducer blocks.

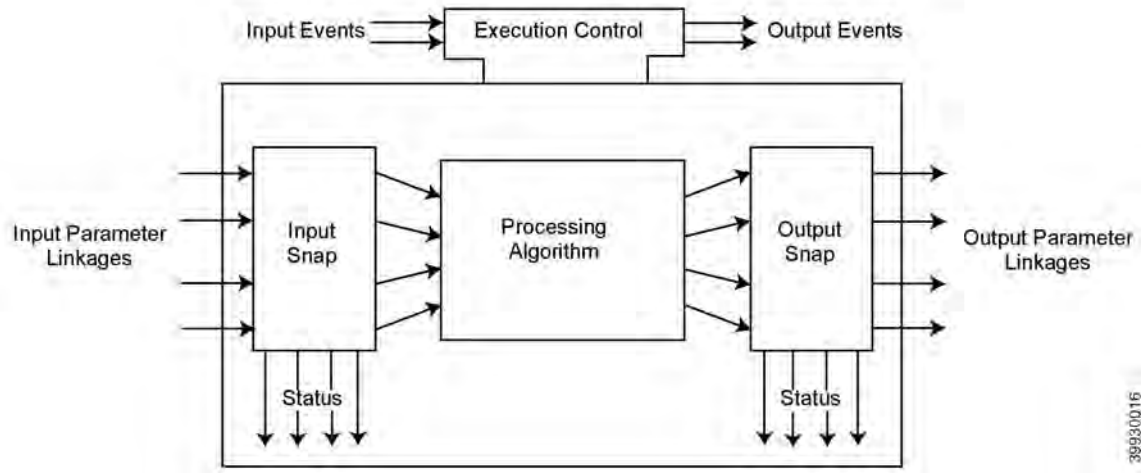
The FOUNDATION specifications and definitions allow vendors to add their own parameters by importing and subclassing specified classes. This approach permits extending function block definitions as new requirements are discovered and as technology advances.

Figure 7-1 illustrates the internal structure of a function block. When execution begins, input parameter values from other blocks are snapped-in by the block. The input snap process ensures that these values do not change during the block execution. New values received for these parameters do not affect the snapped values and will not be used by the function block during the current execution.

Once the inputs are snapped, the algorithm operates on them, generating outputs as itprogresses. Algorithm executions are controlled through the setting of containedparameters. Contained parameters are internal to function blocks and do not appear asnormal input and output parameters. However, they may be accessed and modified remtely, as specified by the fundtion block.

Input events may affect the operation of the algorithm. An execution control function regulates the receipt of input events and the generation of output events during execution of the algorithm. Upon completion of the algorithm, the data internal to the block is saved for use in the next execution, and the output data is snapped, releasing it for use by other function blocks.

Figure 7-1. Function Block Internal Structure



A block is a tagged logical processing unit. The tag is the name of the block. System management services locate a block by its tag. Thus the service personnel need only know the tag of the block to access or change the appropriate block parameters.

Function blocks are also capable of performing short-term data collection and storage for reviewing their behavior.

Device Descriptions

Device Descriptions are specified tool definitions that are associated with the function blocks. Device descriptions provide for the definition and description of the function blocks and their parameters.

To promote consistency of definition and understanding, descriptive information, such as data type and length, is maintained in the device description. Device Descriptions are written using an open language called the Device Description Language (DDL). Parameter transfers between function blocks can be easily verified because all parameters are described using the same language. Once written, the device description can be stored on an external medium, such as a CD-ROM or diskette. Users can then read the device description from the external medium. The use of an open language in the device description permits interoperability of function blocks within devices from various vendors. Additionally, human interface devices,

such as operator consoles and computers, do not have to be programmed specifically for each type of device on the bus. Instead their displays and interactions with devices are driven from the device descriptions.

Device descriptions may also include a set of processing routines called methods. Methods provide a procedure for accessing and manipulating parameters within a device.

Instrument-Specific Function Blocks

In addition to function blocks, Fieldbus devices contain two other block types to support the function blocks. These are the resource block and the transducer block. The resource block contains the hardware specific characteristics associated with a device. Transducer blocks couple the function blocks to local input/output functions.

Resource Blocks

Resource blocks contain the hardware specific characteristics associated with a device; they have no input or output parameters. The algorithm within a resource block monitors and controls the general operation of the physical device hardware. The execution of this algorithm is dependent on the characteristics of the physical device, as defined by the manufacturer. As a result of this activity, the algorithm may cause the generation of events. There is only one resource block defined for a device. For example, when the mode of a resource block is “out of service,” it impacts all of the other blocks.

Transducer Blocks

Transducer blocks connect function blocks to local input/output functions. They read sensor hardware and write to effector (actuator) hardware. This permits the transducer block to execute as frequently as necessary to obtain good data from sensors and ensure proper writes to the actuator without burdening the function blocks that use the data. The transducer block also isolates the function block from the vendor specific characteristics of the physical I/O.

Alerts

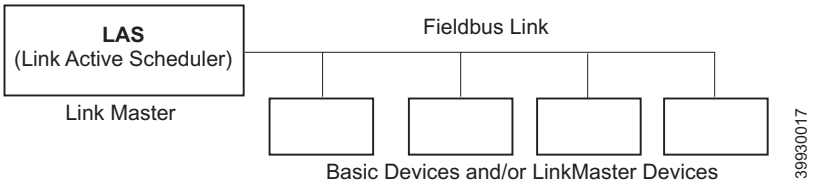
When an alert occurs, execution control sends an event notification and waits a specified period of time for an acknowledgment to be received. This occurs even if the condition that caused the alert no longer exists. If acknowledgment is not received within the prespecified time-out period, the event notification is retransmitted. This assures that alert messages are not lost.

Two types of alerts are defined for the block, events and alarms. Events are used to report a status change when a block leaves a particular state, such as when a parameter crosses a threshold. Alarms not only report a status change when a block leaves a particular state, but also report when it returns back to that state.

Network Communication

Figure 7-2 illustrates a simple Fieldbus network consisting of a single segment (link).

Figure 7-2. Single Link Fieldbus Network



Link Active Scheduler (LAS)

All links have one and only one Link Active Scheduler (LAS). The LAS operates as the us arbiter for the link. The LAS does the following:

- recognizes and adds new devices to the link.
- removes non-responsive devices from the link.
- distributes Data Link (DL) and Link Scheduling (LS) time on the link. Data Link Time is a network-wide time periodically distributed by the LAS to synchronize all device clocks on the bus. Link Scheduling time is a link-specific time represented as an offset from Data Link Time. It is used to indicate when the LAS on each link begins and repeats its schedule. It is used by system management to synchronize function block execution with the data transfers scheduled by the LAS.
- polls devices for process loop data at scheduled transmission times.
- distributes a priority-driven token to devices between scheduled transmissions.

Any device on the link may become the LAS, as long as it is capable. The devices that are capable of becoming the LAS are called link master devices. All other devices are referred to as basic devices. When a segment first starts up, or upon failure of the existing LAS, the link master devices on the segment bid to become the LAS. The link master that wins the bid begins operating as the LAS immediately upon completion of the bidding process. Link masters that do not become the LAS act as basic devices. However, the link masters can act as LAS backups by monitoring the link for failure of the LAS and then bidding to become the LAS when a LAS failure is detected.

Only one device can communicate at a time. Permission to communicate on the bus is controlled by a centralized token passed between devices by the LAS. Only the device with the token can communicate. The LAS maintains a list of all devices that need access to the bus. This list is called the “Live List.”

Two types of tokens are used by the LAS. A time-critical token, compel data (CD), is sent by the LAS according to a schedule. A non-time critical token, pass token (PT), is sent by the LAS to each device in ascending numerical order according to address.

Device Addressing

Fieldbus uses addresses between 0 and 255. Addresses 0 through 15 are reserved for group addressing and for use by the data link layer. For all EMERSON Fieldbus devices addresses 20 through 35 are available to the device. If there are two or more devices with the same address, the first device to start will use its programmed address. Each of the other devices will be given one of four temporary addresses between 248 and 251. If a temporary address is not available, the device will be unavailable until a temporary address becomes available.

OCX FUNCTION BLOCKS

Implemented Function Blocks

Shows the OCX Implemented Function Blocks.

Table 7-1. OCX Implemented Function Blocks

Function Block	Description
Resource Block	
Transducer Block	
Analog Input Block 1 (AI1)	See TB Channel Assignment Table 7-16
Analog Input Block 2 (AI2)	See TB Channel Assignment Table 7-16
Analog Input Block 3 (AI3)	See TB Channel Assigbment Table 7-16
Analog Input Block 4 (AI4)	See TB Channel Assignment Table 7-16
PID Block (PID)	Proportional/Integral/Derivative of any AI-BLOCK
Arithmetic Block (ARTHM)	Arihmetic Function Block
Input Selector Block (ISEL)	Input Selector Function Block

RESOURCE BLOCK

PlantWeb Alerts

The PlantWeb Alerts (PWA) software supports three groups of alarms for three severity levels: 1) Failed, 2) Maintenance, and 3) Advisory. Each PWA can be configured for one or more of the three alarm groups. The PWA alarms and their severity level default settings are listed in Table 7-2.

Table 7-2. Hazardous Area OCX 8800 PWA

PlantWeb Alert	Severity Level Default
Reserved: none	
Sensor Malfunction	Failed
Sensor Degraded	Failed
Thermocouple Malfunction	Failed
Sensor Heater Malfunction	Failed
Sensor Heater Over Temperature	Failed
Sensor Heater Temperature Variance	Maintenance
Calibration Error	Maintenance
Calibration Recommended	Advisory
NV Memory Failure	Failed
NV Writes Deferred	Advisory
High Electronics Temperature	Maintenance
ADC Failure	Failed
Line Input Out of Range	Advisory
Inter Board Comm Failure	Failed
Simulate Active	Advisory

Each alarm condition can be “Enabled”, “Disabled”, or have alarm reporting “Suppressed”. The PWA alarms must be “Enabled” to allow the corresponding alarm condition to be detected. The PWA alarms can be “Suppressed” to mask out failures from annunciation.

Mapping of PWA

Description of the PlantWeb Alerts that are supported by the Hazardous Area OCX 8800 Fieldbus Output Board are listed in Table 7-3.

Figure 7-3. Description of PlantWeb Alerts

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Alerts	Alarms	AMS Tab	What does the alert indicate?	Recommended Action	Description
Sensor Malfunction	Transducer Block: 1) O_2 Cell Open 2) Comb Cell Error	Sensor Alerts	This alert is active when the sensor is indicating a very high or unexpected output.	Check sensor wires for loose or broken connection or replace the cell.	1) The oxygen cell interface is designed to indicate a very high output if the cell becomes disconnected from the electronics. It is possible that a wire connection to the cell, either in the probe tip or at the electronics, is loose or broken. The cell may also be damaged from mechanical stress. In extreme cases, a very low oxygen concentration in the process may cause this alarm. Diagnosis must be done at the analyzer. Refer to Section 8: Troubleshooting for details. 2) This problem could be caused by a mechanical failure in the sensor housing or at the electronics. An open circuit in the combustible sensor could also cause this alarm. Refer to Section 8: Troubleshooting for details.
Sensor Degraded	Transducer Block: O_2 Cell Impedance High	Sensor Alerts	This alert is active when the oxygen sensor impedance indicates that the cell is beyond its useful life.	Replace the oxygen cell.	Oxygen cells will degrade over time due to aging and corrosion. An increasing cell resistance is a good indicator of reduced cell performance. As the cell impedance increases, the cell output falls off and response time increases. Calibrating the instrument will compensate for the increased cell resistance up to several hundred ohms, beyond which the cell is no longer functional. Diagnosis must be done at the analyzer. Refer to Section 8: Troubleshooting for details.
Thermo-couple Malfunction	Transducer Block: 1) O_2 T/C Open 2) O_2 T/C Shorted 3) O_2 T/C Reversed 4) Comb T/C Open 5) Comb T/C Shorted 6) Comb T/C Reversed 7) SB T/C Open 8) SB T/C Shorted 9) SB T/C Reversed	T/C Heater Alerts	This alert indicates a miswired or faulty thermocouple.	Check the thermocouple wires for loose or broken connections, short circuit condition, reverse wire condition.	When the heater thermocouple alarms are initiated, they diagnose one of three states: 1) Open 2) Shorted 3) Reversed The problem could be caused by a mechanical failure in the probe tip or at the electronics. Power to the device must be cycled to resume operation. Diagnosis must be done at the analyzer. Refer to Section 8: Troubleshooting for details.

Alerts	Alarms	AMS Tab	What does the alert indicate?	Recommended Action	Description
Sensor Heater Malfunction	Transducer Block 1) O_2 Heater Failure 2) Comb Heater Failure 3) SB Heater Failure 4) O_2 Heater Ramp Rate Exceeded 5) Comb Heater Ramp Rate Exceeded 6) SB Heater Ramp Rate Exceeded 7) Heater Relay Failed	T/C Heater Alerts	This alert indicates that no measurable heat energy is being detected at the oxygen sensor or that the heater temperature is rising too fast.	Check heater circuit for lose or broken connections, check thermocouple wiring, test or replace the heater.	Mechanical or thermal stress may eventually cause the sensor heater to fail. The resistance of a properly functioning cell heater will measure less than 100 ohms. A failed heater will generally measure as an open circuit. Diagnosis must be done at the analyzer. Refer to Section 8: Troubleshooting for details. The Heater Ramp Rate Exceeded problem is usually caused by the inability of the device to limit power to the heater. This could be caused by a shorted triac component on the power supply in the electronics stack. Diagnosis must be done at the analyzer. Refer to Section 8: Troubleshooting for details.
Sensor Heater Over Temp-erature	Transducer Block: 1) O_2 Cell Temp. Very High 2) Comb Temp. Very High 3) SB Temp Very High	TC Heater Alerts	This alert indicates a very high heater temperature; temperature is rising too fast.	Check heater wiring, check thermocouple wiring or replace the electronics stack.	A heater over-temperature/out of control problem would generally be caused by the inability of the device to limit power to the heater. This could be caused by a shorted triac on the power supply in the electronics stack.
Sensor Heater Temp-erature Variance	Transducer Block: 1) O_2 Cell Temp. Low 2) O_2 Cell Temp. High 3) Comb Temp. Low 4) Comb Temp. High 5) SB Temp. Low 6) SB Temp. High	T/C Heater Alerts	This alert indicates a sensor heater temperature that is too high or too low.	Allow instrument several minutes to reach proper temperature or check power supply.	Cell temperature control may become erratic for the following reasons: 1) Temperature is settling during startup. 2) Large variations in process temperature or flow. 3) Fluctuations or noise in the power supplied to the instrument.
Calibration Error	Transducer Block: 1) O_2 Calibration Failed 2) Comb Calibration Failed 3) Calibration Warning	Calib-ration Alerts	This alert indicates that the slope and constant values determined from the calibration did not fall within an acceptable range.	Check the calibration gas supplies and connections.	Make sure the oxygen concentrations of the calibration gases match the concentration values in the device. If the calibration has been performed correctly this alarm may indicate that the sensor requires replacement. Refer to Section 8: Troubleshooting for details.
Calibration Recommended	Transducer Block: Calibration Recommended	Calib-ration Alerts	This alert indicates that the sensor resistance has changed by a predetermined amount since the last calibration.	Check instrument accuracy and/or calibrate.	Oxygen cells will degrade over time due to aging and corrosion. An increasing cell resistance is a good indicator of reduced cell performance. As the cell impedance increases, the cell output falls off and response time increases. Calibrating the instrument will compensate for the increased cell resistance. If using the device with an IMPS or SPS calibration sequencer, increased cell impedance can automatically trigger a calibration.

Alerts	Alarms	AMS Tab	What does the alert indicate?	Recommended Action	Description
NV Memory Failure	Transducer Block: EEPROM Corrupt Resource Block: 1) Manufacturing 2) Block Integrity Error 3) NV Integrity Error 4) ROM Integrity Error	FF/ Device Alerts	The non-volatile parameter storage on the CPU board has become unreliable.	At startup, wait 2 minutes with power applied and then cycle power again or reset device.	This alarm will generally occur during a startup condition. Rarely, the device could be powered down while a parameter is being stored to the non-volatile memory. The parameter will then be tagged as bad on the next power on and the memory contents will be written with default parameters. Calibration data may be lost and the unit should be recalibrated. If the unit does not recover automatically, the memory may be faulty and the electronics stack should be replaced. Refer to Section 8: Troubleshooting for details.
NV Writes Deferred	Resource Block: 1) NV Writes Deferred	FF/ Device Alerts			A high number of writes has been detected to non-volatile memory. To prevent premature failure of the memory, the write operations have been deferred. The data will be saved on a 6 hour cycle. This condition usually exists because a program has been written that writes to Function block parameters not normally expected to be written to on a cyclic basis.
High Electronics Temp-erature	Transducer Block: High Electronic Temperature	Device Alerts	This alert indicates that the electronics temperature has exceeded 80°C. The device will cease to operate reliably beyond 85°C.	Evaluate mounting location and environment.	The device may require special mounting considerations if installed in a very hot location.
ADC Failure	Transducer Block: 1) ADC Timeout Error 2) ADC Reference Error	Device Alerts	This alert indicates faulty operation of the device electronics.	Cycle power or replace the electronics stack.	The Analog to Digital Converter (ADC) is continuously monitored by the device for correct operation. Refer to Section 8: Troubleshooting for details.

Alerts	Alarms	AMS Tab	What does the alert indicate?	Recommended Action	Description
Line Input Out of Range	Transducer Block: 1) Line Frequency Error 2) Line Voltage Low 3) Line Voltage High	Device Alerts	This alert indicates that the line input power to the device is outside the proper operating limits.	Check line input power for proper voltage and frequency.	The device power supply continuously monitors the line input. Measured variations in the line input power are used to compensate the sensor heater control and check for faulty line conditions. Refer to Section 8: Troubleshooting for details.
Inter Board Communication Failure	Transducer Block: Inter Board Communication Failure	FF/ Device Alerts	This alert indicates a communication failure between the FF board and the device.	Verify device is powered. Check the installation of the Fieldbus Output Board on its carrier board. If the above are OK, replace the carrier board and/or Fieldbus Output Board.	There is no communication possible between the Fieldbus Output Board and the device's computer board.
Simulate Active		FF/ Device Alerts	This alert occurs when the PWA simulate mode is active.		The PWA active parameters can now be written. The resource block detailed status parameters and the internal alerts in the Transducer Block where the PWA active alarms originate can also be written.

PWA Simulate

Setting PWA_SIMULATE to ON allow simulating the PWA parameters, FAILED_ACTIVE, MAINT_ACTIVE and ADVISE_ACTIVE. "Allowing Simulating" means that these parameters get write permission and the host's written value is the only one which is used for parameter's read back value. The data which comes from the Hazardous Area OCX 8800 is not used in this case.

Fieldbus/PWA Simulate

Fieldbus simulation and PWA simulation can be enabled and disabled using the DD method. Use the "Transmitter Options" method to enable/disable the Fieldbus or PlantWeb Alerts simulation.

Selecting "Fieldbus simulation" enables both the Fieldbus function block simulation and PWA simulation. Selecting "PWA simulation" enables PlantWeb Alert simulation only.

⚠CAUTION

Do not use the PWA Simulate feature for normal operations. When used improperly the Simulate feature can alter, disable, or activate device alarms.

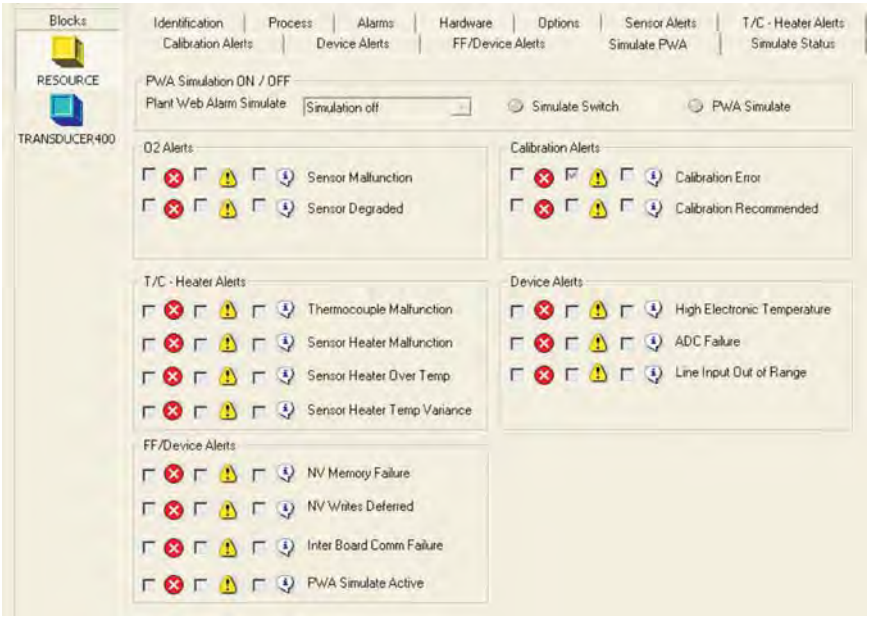
The simulation feature should not be used for normal operations. This feature is to be used by authorized personnel for testing or demonstration purposes only.

Configure Simulation from AMS

Use the following procedure to configure PWA simulation using AMS.

1. Run "Transmitter Options" method.
2. In the "Transmitter Options" menu, select either "Simulate Switch" or "PWA Simulate".
3. Select "Enable" to enable the simulation feature or "Disable" to disable the simulation feature.
4. Once the method is complete, select the "Simulate PWA" tab in the Resource Block, Figure 7-4. If the simulation is enabled, the "PlantWeb Alarm Simulate" parameter is configurable otherwise it is read-only.
5. Now select Simulation on/off from the "Simulate PWA" screen. When Fieldbus Simulation is on, the "Simulation Switch" LED is illuminated. When PWA simulation is on, the "PWA Simulate" LED is illuminated.

Figure 7-4. Simulate PWA Screen



6. If PWA Simulation is on, all PWA active parameters and Resource and Transducer Block status parameters are configurable. Otherwise they are read-only.
7. To simulate PlantWeb alerts, use the "Simulate PWA" screens in the Resource Block. To simulate block alarms, use "Simulate TB Temperature Sensor - Temperature Status", "Simulate TB Temperature Status", or "Simulate TB Calibration Device - FF Status" in the Transducer Block.
8. Select "Device Diagnostics" to view the active PWA alarms.
9. When "Device Diagnostics" is selected, press the "Status" button to see the Resource or Transducer Block detailed status displays.

Configure Simulation with the Model 375 Field Communicator

Use the following procedure to configure PWA simulation using the Model 375 Field Communicator.

1. Run "Transmitter Options" method in the Resource Block (Resource | Methods).
2. In the "Transmitter Options" menu, select either "Simulate Switch" or "PWA Simulate".
3. Select "Enable" to enable PWA simulation or "Disable" to disable the simulation feature.
4. Once the method is complete, select "Resource | Simulate PWA" in the Resource Block. If the simulation is enabled, the "PWA Simulate" parameter is configurable. Otherwise it is read-only.
5. Now select Simulation on/off from the "PWA Simulate" parameter. When PWA Simulation is on, all of the PWA active parameters and the Resource and Transducer Block status parameters are configurable. Otherwise they are read-only.
6. To simulate PlantWeb Alerts, select the alerts listed under “Failed Active”, “Maintenance Active” and “Advisory Active” (Resource | Simulate PWA).
7. To simulate block alarms, select the alarms listed under “Detailed Status” in the Resource Block (Resource | Simulate Status) or under “Detailed Status” in the Transducer Block (Transducer | Simulate Status).
8. Select Resource|PWA SubStatus to see the active PWA alarms and masks. Select Fail Active, Maintenance Active or Advisory Active for active PWA alarms.
9. Select Resource | Status | Detailed Status or Transducer | Status | Detailed Status to see the Resource or Transducer Block detailed status.

Support Resource Block Errors

Resource Block

Out of Service
Set Whenever the resource block actual mode is OOS.

Power Up
Set whenever the FF card powers up.

Block Configuration Error
Configuration Error is used to indicate that you had selected an item in FEATURES_SEL or CYCLE_SEL that was not set in FEATURES or CYCLE_TYPE, respectively.

Simulation Active
Set whenever the Fieldbus Simulate Switch is set to ON at the Fieldbus card or software simulate option enabled.

Transducer Block

Out of Service
Set whenever the transducer block actual mode is OOS.

Input Failure
Set whenever there is a communication error between the Fieldbus card and the OCX.

Simulation Active
Set whenever the Fieldbus Simulate Switch is set to ON at the Fieldbus card or software simulate option enabled.

Other Error
Set whenever XD_ERROR is non-zero.

TRANSDUCER BLOCK

The Transducer Block was designed to provide the information necessary to interface Hazardous Area OCX 8800 to the Fieldbus.

Transducer Block Parameters

Table 7-3 gives a description of all parameters, or gives the location of the Fieldbus specifications the description can be found.

Table 7-3. Transducer Block Parameter Description

Parameter Mnemonic	Valid Range	Units	Description
ALARM_RELAY_EVENT1	See Table 7-7	Enumerated	The first of three conditions that cause the alarm output to turn on..
ALARM_RELAY_EVENT2	See Table 7-7	Enumerated	The second of three conditions that cause the alarm output to turn on.
ALARM_RELAY_EVENT3	See Table 7-7	Enumerated	The third of three conditions that cause the alarm output to turn on.
ALARM_RELAY_STATE	0: Off – 1: On	Enumerated	The state of the alarm output.
ALERT_KEY			See FF-891 section 5.3.
ANALYZER_SW_BUILD_ DATE			The date the analyzer software was built.
ANALYZER_SW_BUILD_ NUMBER			The build number of the analyzer software.
ANALYZER_SW_ CHECKSUM			The checksum of the analyzer software.
ANALYZER_SW_VERSION			The version of the analyzer software.
BLOCK_ALM			See FF-891 section 5.3.
BLOCK_ERR			See FF-891 section 5.3.
BLOWBACK_DURATION	1-5	Seconds	The amount of time the blowback solenoid will be on.
BLOWBACK_ENABLED	0: No – 1: Yes	Enumerated	Enables or disables the automatic blowback cycle.
BLOWBACK_INTERVAL	0-32767	Minutes	The time between blowback cycles.
BLOWBACK_PURGE_TIME	0-500	Seconds	The amount of time before returning the output to process after performing a blowback.
BLOWBACK_STATE	0, 1, 2	Enumerated	The current state of the blowback cycle. (0=Idle, 1=Blow, 2=Purge)
CAL_GAS_TIME	60-1200	Seconds	The amount of time calibration gas should flow before a reading is taken.
CAL_PURGE_TIME	60-1200	Seconds	The amount of time before returning the output to process after calibrating.
CAL_REC_ENABLE	0: No – 1: Yes		Enable/disable calibration recommended alarm.
CAL_RESULTS	See Table 7-10	Bit Enum	Calibration result.
CAL_STATE	See Table 7-4	Enumerated	The current state of the calibration cycle.
CAL_STATE_STEP			Initiates a calibration or goes to the next calibration step.
CAL_STATE_TIME		Seconds	The time left in the current calibration step.
COLLECTION_DIRECTORY			See Transducer Block Specification, part 1. FF-902, page 11.
COMB _SENSOR_CAL_LOC			See FF-903 section 3.3.
COMB_SENSOR_CAL_ METHOD			See FF-903 sections 3.3 and 4.5.

Parameter Mnemonic	Valid Range	Units	Description
COMB _SENSOR_CAL_WHO			See FF-903 section 3.3.
COMB_AUTOCAL_ INTERVAL	0-9999	Hours	The time between automatic calibrations of the combustibles sensor.
COMB_CAL_POINT	0-55000	PPM	The value of the combustibles test gas.
COMB_CONSTANT	-99.0-99.0	PPM	The combustibles calibration constant.
COMB_DELTA_ RESISTANCE		Ohms	The raw value of the combustibles level input. This is the difference between the active and reference RTDs.
COMB_FAILED_CONSTANT		PPM	This is the constant value calculated from the last failed Combustibles calibration.
COMB_FAILED_SLOPE		PPM/Ohm	This is the slope value calculated from the last failed Combustibles calibration.
COMB_HTR_DUTYCYCLE			Combustibles heater duty cycle.
COMB_PERCENT_OF_ RANGE		%	The percent of range of the current combustibles reading.
COMB_PREVIOUS_ CONSTANT		PPM	The combustibles calibration constant from the previous good calibration.
COMB_PREVIOUS_SLOPE		PPM/Ohm	The combustibles calibration slope from the previous good calibration.
COMB_PRIMARY_VALUE			The value and status of the combustibles concentration reading.
COMB_PRIMARY_VALUE_ RANGE			The High and Low range limit values, the engineering units code, and the number of digits to the right of the decimal point for the combustibles reading.
COMB_PRIMARY_VALUE_ TYPE	See FF903 section 4.1		See FF-903 section 3.3.
COMB_REFERENCE_ OHMS		Ohms	The raw value of the combustibles reference input.
COMB_SECONDARY_ VALUE			The combustibles cell temperature. This is the determined from the value of the combustibles reference RTD.
COMB_SECONDARY_ VALUE_RANGE			The High and Low range limit values, the engineering units code, and the number of digits to the right of the decimal point for the combustibles cell temperature reading.
COMB_SENSOR_CAL_ DATE			See FF-903 section 3.3.
COMB_SENSOR_ EXCITATION		mA	Combustible Reference current.
COMB_SENSOR_TYPE			See FF-903 section 3.3 and 4.3.
COMB_SETPOINT		°C	Combustibles heater temperature set point.
COMB_SLOPE	200-4500	PPM/Ohm	The combustibles calibration slope.
COMB_SLOPE_WARNING	25.0-99.0	% of FS	The combustible slope warning threshold.
COMB_T90	0-300	Seconds	The amount of time that the combustibles process variable will take to reach 90% of the actual process variable.
COMB_TEMP_MAX		°C	The highest Combustibles temperature read since power on.
COMB_THERMOCOUPLE_ INPUT		mV	Combustible Block T/C voltage (Valid only with Type 3 sensor).
COMB_TIME_TO_NEXT_ CAL	0-9999	Hours	The time until the next automatic calibration of the combustibles sensor.
COMB_TOL_CHECK	0: No – 1: Yes		Combustible calibration gas tolerance check.
COZERO_DURATION	120-600	Seconds	The duration of the Combustibles sensor zero cycle.
COZERO_ENABLED	0: Off – 1: On	Enumerated	Indicates whether Combustibles sensor zero is enabled.
COZERO_INTERVAL	60-480	Minutes	The time between Combustibles sensor zero cycles.
COZERO_OUTTRAK	0, 1, 2, 3	Enumerated	Indicates whether the Combustibles analog output should track the input during Combustibles sensor zero or lock at the last process reading. (0=None, 1=O_2, 2=CO_2, 3= Both)

Parameter Mnemonic	Valid Range	Units	Description
COZERO_PURGE_TIME	60-180	Seconds	The duration of the Combustibles sensor zero purge.
COZERO_STATE	0, 1, 2		The current step of the Combustibles sensor zero cycle. (0=Idle, 1=Flowing, 2=Purging)
COZERO_UPDATE	0: Off – 1: On	Enumerated	Indicates whether the Combustibles calibration constants should be updated after Combustibles sensor zero.
DETAILED_STATUS_1	0-16777215	Bit Enum	A bit-enumerated value used to communicate the status of the OCX. (This is similar in nature to the command 48 status bits in HART).
DETAILED_STATUS_2	0-16777215	Bit Enum	A bit-enumerated value used to communicate the status of the OCX. (This is similar in nature to the command 48 status bits in HART).
ELECTRONICS_TEMP		°C	The current temperature reading of the electronics temperature sensor.
ELECTRONICS_TEMP_ INPUT		mV	The current voltage reading of the electronics temperature sensor.
INITIATE_BLOWBACK	1=Do a manual blowback		This initiates a blowback cycle. 1=Do a manual blow back
LINE_FREQUENCY		Hz	The Calculated line frequency.
LINE_VOLTAGE		Volts	The calculated line voltage.
MAX_ELECTRONICS_TEMP		°C	This is the maximum electronics temperature seen by the analyzer.
MAX_TEMP_RESET	1=Reset max temperatures		This resets the maximum temperatures.
MODE_BLK			See FF-891 section 5.3.
O2_AUTOCAL_INTERVAL	0-9999	Hours	The time between automatic calibrations of the O_2 sensor.
O2_CAL_POINT_HI	0-40	%	The value of the O_2 high test gas. This gas is also used as the low gas for calibrating the combustibles sensor.
O2_CAL_POINT_LO	0-40	%	The value of the O_2 low test gas.
O2_CELL_IMPEDANCE		Ohms	The instaneous impedance value for the O_2 cell.
O2_CONSTANT	-20.0-20.0	mV	The O_2 calibration constant.
O2_FAILED_CONSTANT		mV	This is the constant value calculated from the last failed O_2 calibration.
O2_FAILED_SLOPE		mV/Decade	This is the slope value calculated from the last failed O_2 calibration.
O2_HTR_DUTYCYCLE			O_2 heater duty cycle.
O2_IMPEDANCE CAL		Ohms	The impedance value that was calculated as a result of the current successful O_2 calibration.
O2_PERCENT_OF_RANGE		%	The percent of range of the current O_2 reading.
O2_PREVIOUS_CONSTANT		mV	The O_2 calibration constant from the previous good calibration.
O2_PREVIOUS_ IMPEDANCE		Ohms	The impedance value from the previous good calibration.
O2_PREVIOUS_SLOPE		mV/Decade	The O_2 calibration slope from the previous good calibration.
O2_PRIMARY_VALUE			The value and status of the O_2 concentration reading.
O2_PRIMARY_VALUE_ RANGE			The High and Low range limit values, the engineering units code, and the number of digits to the right of the decimal point for the O_2 reading.
O2_PRIMARY_VLUE_TYPE	See F-903 section 4.1		See FF-903 section 3.3.
O2_SECONDARY_VALUE			The temperature of the O_2 cell.
O2_SECONDARY_VALUE_ RANGE			The High and Low range limit values, the engineering units code, and the number of digits to the right of the decimal point for the O_2 cell temperature.
O2_SENSOR_CAL_DATE			See FF-903 section 3.3.
O2_SENSOR_CAL_LOC			See FF-903 section 3.3.
O2_SENSOR_CAL_ METHOD			See FF-903 sections 3.3 and 4.5.
O2_SENSOR_CAL_WHO			See FF-903 section 3.3.
O2_SENSOR_INPUT		mV	The raw value of the O_2 sensor input.
O2_SENSOR_TYPE			See FF-903 section 3.3 and 4.3.

Parameter Mnemonic	Valid Range	Units	Description
O2_SETPOINT		°C	O_2 heater temperature set point.
O2_SLOPE	34.5-57.5	mV/Decade	The O_2 calibration slope.
O2_T90	0-300	Seconds	The amount of time that the O2 process variable will take to reach 90% of the actual process variable.
O2_TEMP_MAX		°C	The highest O_2 temperature read since power on.
O2_THERMOCOUPLE_ INPUT		mV	The raw value of the O_2 temperature input.
O2_TIME_TO_NEXT_CAL	0-9999	Hours	The time until the next automatic calibration of the O_2 sensor.
O2_TOL_CHECK	0: No – 1: Yes		O_2 calibration gas tolerance check.
OPERATING_MODE		Enumerated	Device Operating Mode. See Table 7-8.
PCD_COUNTER			Power cycle drop counter.
PCDC_ENABLE	0: No – 1: Yes		Enable/disable power cycle drop detect.
PCN_COUNTER			Power cycle noise counter.
SB_HTR_DUTYCYCLE			Sample Block heater duty cycle.
SB_SETPOINT		°C	Sample Block heater temperature set point.
SB_TEMP		°C	The temperature of the sample line.
SB_TEMP_MAX		°C	The highest Sample Block temperature read since power on.
SB_THERMOCOUPLE_ INPUT		mV	The raw value of the sample line temperature input.
SENSOR_HOUSING_TEMP		°C	Sensor Housing temperature (Valid only with Type 3 sensor).
SENSOR_HOUSING_ TEMP_INPUT		mV	Sensor Housing CJC voltage (Valid only with Type 3 sensor).
SENSOR_HOUSING_ TEMP_MAX		°C	The highest Sensor Housing temperature read since power on.
SENSOR_HOUSING_TYPE	0, 1, 2, 3	Enumerated	This is the Sensor Housing type setting through the DIP switch. (0=Type 1, 1=Type 2, 2=Type3, 3=Invalid)
SOLENOIDS_PRESENT	0: No – 1: Yes	Enumerated	This determines whether a calibration cycle will automatically step through, turning solenoids on and off to switch test gas, or wait for an operator to manually switch gases and acknowledge.
ST_REV			See FF-891 section 5.3.
STATS_ATTEMPTS			Total number of messages sent to the transducer a/d board.
STATS_FAILURES			Total number of failed a/d board message attempts.
STATS_TIMEOUTS			Total number of timed out a/d board message attempts.
STRATEGY			See FF-891 section 5.3.
TAG_DESC			See FF-891 section 5.3.
TRANSDUCER_ DIRECTORY			See FF-903 section 3.3.
TRANSDUCER_TYPE			See FF-903 sections 3.3.
UPDATE_EVT			See FF-891 section 5.3.
VERIFY_STATE	0 through 5	Enumerated	The current state of the Calibration Check. (0=Idle 1, 1=Flow High O_2, 2=Flow Lo O_2, 3=Flow High COe, 4=Purge Gas, 5=Done)
VERIFY_STATE_STEP	0, 1, 2,.3, 6	Enumerated	Initiates a calibration verify of O_2 or Combustibles gas. (0=Start Flow High O_2, 1=Start Flow Lo O_2, 3=Start Flow High COe, 3=Purge Gas, 6=No Effect)
VERIFY_STATE_TIME		Seconds	Time remain for the current Calibration Check state.
XD_ERROR			See FF-903 section 3.3.

Transducer Block Enumerations

Calibration States

During a running calibration procedure, the states below reflect the current step that the calibration is running in. Refer to Table 7-4.

Table 7-4. Calibration State-Values

Index	CAL_STATE Description	Operator Ack Required to Continue
0	Idle	Yes, cal can also be initiated from internally generated events.
1	Apply O2 Low Gas	Yes, If Parameter "Solenoids Present" is 0
2	Flow O2 Low Gas	No
3	Read O2 Low Gas	No
4	Apply O2 High Gas	Yes, If Parameter "Solenoids Present" is 0
5	Flow O2 High Gas	No
6	Read O2 High Gas	No
7	Apply Comb Low Gas	Yes, If Parameter "Solenoids Present" is 0
8	Flow Comb Low Gas	No
9	Read Comb Low Gas	No
10	Apply Comb High Gas	Yes, If Parameter "Solenoids Present" is 0
11	Flow Comb High Gas	No
12	Read Comb High Gas	No
13	Stop Gas	Yes, If Parameter "Solenoids Present" is 0
14	Purge	No
15	Abort	Yes, If Parameter "Solenoids Present" is 0

Calibration Step Command

During a calibration, the CAL_STATE_STEP command/parameter controls the calibration procedure. The procedure will progress forward on the value of CALIB_STATE.

Table 7-5. Calibration Control Enumerations

CAL_STATE_STEP Description
No Event
Start O2 Calibration
Start Combustibles Calibration
Start O2 and Combustibles Calibration
Step Calibration
Abort Calibration

To start a calibration procedure of a sensor is only allowed if there is no procedure already running on the same sensor. If we do not want to wait for finishing the already running procedure we have first to cancel it before starting the new procedure.

Blowback States

Table 7-6. Blowback State Enumerations

BLOWBACK_STATE Description
Idle
Blow
Purge

Alarm Events

Table 7-7. Alarm Event Enumerations

ALARM_RELAY_EVENT Description
Off
In Calibration
O2 Cell Temp Error
O2 Heater Open
O2 Cell Bad
Cal Failed
Cal Warn
High Electronics Temp
Unit Failure
SL Temp Error
Comb Cell Temp Error
Power Input Error
In COe Zero
All

Operating Mode

Table 7-8. Operating Mode Enumerations

Operating Mode Description
POWER UP
WARMUP
STABILIZE
NORMAL
CALIBRATING
CALVERIFY
BLOWBACK
COZERO
ALARM
SYS FAULT
CAL RECOMMENDED

Sensor Housing Type

Table 7-9. Sensor Housing Enumerations

SENSOR_HOUSING_TYPE Description
TYPE 1
TYPE 2
TYPE 3

Cal Results

Table 7-10. Cal Results Bit Enumerations

CAL_RESULTS Description
O2 Slope Error
O2 Constant Error
O2 Tolerance Check Failed
CO Slope Error
O2 Constant Error
CO Tolerance Check Failed
CO Slope Warning

Calibration Verify Status

During a running calibration verify procedure, the states below reflect the current step that the calibration verify is running in.

Table 7-11. Calibration Verify State Values

VERIFY_STATE Description
Idle
Flow High O2 Gas
Flow Low O2 Gas
Flow High COe Gas
Purge Gas
Done

Calibration Verify Step Control

During a calibration, the VERIFY_STATE_ STEP command /parameters control the calibration verify procedure.

Table 7-12. Calibration Verify Step Values

VERIFY_STATE_STEP Description
Start Flow High O2 Gas
Start Flow Low O2 Gas
Start Flow High COe Gas
Purge Gas
No Effect

COe Zero States

Table 7-13. COe Zero State Enumerations

COZERO_STATE Description
Idle
Flowing
Purging

COe Out Tracks

Table 7-14. COe Out Tracks Enumerations

COZERO_OUTTRAK Description
None
O2
CO2
Both

Detailed Status

Table 7-15. Detailed Status

Alarm Number	Description	Value of XD_ERROR (see FF-903)
0	No alarm active	
1	O2 Cell Open	Mechanical Failure
2	O2 Cell Impedance High	Mechanical Failure
3	O2 Thermocouple Open	Mechanical Failure
4	O2 Thermocouple Shorted	Mechanical Failure
5	O2 Thermocouple Reversed	Mechanical Failure
6	O2 Cell Temperature Low	Mechanical Failure
7	O2 Cell Temperature High	Mechanical Failure
8	O2 Cell Temperature Very High	Mechanical Failure
9	O2 Heater Failure	Mechanical Failure
10	O2 Heater Ramp Rate	Electronics Failure
11	Combustibles Cell Error	Mechanical Failure
12	Combustibles Thermocouple Open	Mechanical Failure
13	Combustibles Thermocouple Shorted	Mechanical Failure
14	Combustibles Thermocouple Reversed	Mechanical Failure
15	Combustibles Temperature Low	Mechanical Failure
16	Combustibles Temperature High	Mechanical Failure
17	Combustibles Temperature Very High	Mechanical Failure
18	Combustibles Heater Failure	Mechanical Failure
19	Combustibles Heater Ramp Rate	Electronics Failure
20	Sample Block Thermocouple Open	Mechanical Failure
21	Sample Block Thermocouple Shorted	Mechanical Failure
22	Sample Block Thermocouple Reversed	Mechanical Failure
23	Sample Block Temperature Low	Mechanical Failure
24	Sample Block Temperature High	Mechanical Failure
25	Sample Block Temperature Very High	Mechanical Failure
26	Sample Block Heater Failure	Mechanical Failure
27	Sample Block Heater Ramp Rate	Electronics Failure

Alarm Number	Description	Value of XD_ERROR (see FF-903)
28	O2 Calibration Failed	Calibration Error
29	Combustible Calibration Failed	Calibration Error
30	Combustible Calibration Warning	Calibration Error
31	O2 Calibration Recommended	Calibration Error
32	EEPROM Corrupt	Data Integrity Error
33	High Electronics Temperature	Electronics Failure
34	ADC Timeout Error	Electronics Failure
35	ADC Reference Error	Electronics Failure
36	Heater Relay Failed	Electronics Failure
37	Line Frequency Error	Electronics Failure
38	Line Voltage Low	Electronics Failure
39	Line Voltage High	Electronics Failure
40	Inter-board Communication Failure	Electronics Failure
--	Reserved for FB	

Transducer Block Channel Assignments for AI Blocks

The following table lists the OCX transducer block I/O channels for the AI block.

Table 7-16. I/O Channel Assignments

Transducer Block Channel Value	Process Variable	XD_SCALE UNITS
1	O2 Concentration	%
2	Combustibles Concentration	PPM
3	O2 Cell Temperature	°C
4	Combustibles Cell Temperature	°C

The following table lists the recommended Settings for the OCX transducer block I/O channels for the AI Blocks

Table 7-17. Recommended Settings for the I/O Channel Assignments for the AI Blocks

Transducer Block I/O Channel Value	LTYPE	XD_SCALE 0%	XD-Scale 100%	Units	OUT_SCALE 0%	OUT_SCALE 100%	Units
1	Direct	0	100	%	0	100	%
2	Direct	0	1000	PPM	0	1000	PPM
3	Direct	0	1000	°C	0	1000	°C
4	Direct	0	1000	°C	0	1000	°C

Transducer Block Channel Status

The status of channel 1 to 4 are affected by the state of unit alarm. In all cases, the channel will read what it believes the correct sensor values. Self-Clearing alarms are reset when the alarm condition goes away. All others require the device be restarted.

Table 7-18 indicates channel status under indicated device conditions (Occurence). Unless otherwise indicated in the table, the status values are:

- Occurence: Normal
- Quality Value: GOOD
- Quality Substatus Value: NON_SPECIFIC
- Limit Value: NOT_LIMITED

Table 7-18. I/O Channel Status

Channel	Occurence	Quality Value	Quality Substatus Value	Limit Value
1,2	Powerup, Warmup, Stablize	BAD	NON_SPECIFIC	NOT_LIMITED
1,2	Normal	GOOD	NON_SPECIFIC	NOT_LIMITED
1,2	Calibrating, Cal Verify, Blow Back, COe Zero,	UNCERTAIN	SENSOR_CONVERSION_INACCURATE	NOT_LIMITED
1,2	Alarm (Temperature Low & High, Cell Bad/Error)	UNCERTAIN	SENSOR_CONVERSION_INACCURATE	NOT_LIMITED
1,2	System Fault	BAD	DEVICE_FAILURE	NOT_LIMITED
3,4	Powerup, Warmup, Stablize	GOOD	NON_SPECIFIC	NOT_LIMITED
3,4	Normal	GOOD	NON_SPECIFIC	NOT_LIMITED
3,4	Calibrating, Cal Verify, Blow Back	GOOD	NON_SPECIFIC	NOT_LIMITED
3,4	Alarm, System Fault (Temperature Related Alarms: T/C Open, T/C Shorted, T/C Reversed, ADC Error)	BAD	DEVICE_FAILURE	CONSTANT
3,4	Temp Low & High	Good	ACTIVE_BLOCK_ALARM	NOT_LIMITED

Transducer Block Simulate

Setting PWA_SIMULATE to ON also allows simulating TB status and to check the correct mapping onto the PWA's FAILED_ACTIVE, MAINT_ACTIVE, and ADVISE_ACTIVE parameters.

Support Transducer Block Errors

Out of Service

Set whenever the transducer block actual mode is OOS.

Input Failure

Set whenever there is a communication error between the Fieldbus A2D card and the OCX.

Simulation Active

Set whenever the Fieldbus Simulate Switch is set to ON at the Fieldbus A2D card or software simulate option is enabled.

Other Error

Set whenever XD_ERROR is non-zero.

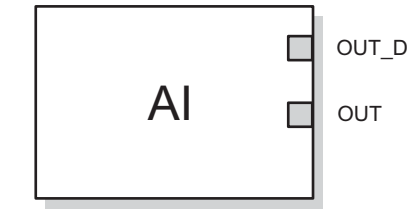
ANALOG INPUT (AI) FUNCTION BLOCK

Introduction

The Hazardous Area OCX 8800 has four transducer block Input/Output channels (Table 7-20) for the AI function blocks. The status of channel values are defined in Table 7-22.

The Analog Input (AI) function block (Figure 7-5) processes field device measurements and makes them available to other function blocks. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement. The measuring device may have several measurements or derived values available in different channels. Use the channel number to define the variable that the AI block processes.

Figure 7-5. AI Function Block



OUT = The block output value and status
OUT_D = Discrete output that signals a selected alarm condition

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The Analog Input (AI) function block processes field device measurements and makes them available to other function blocks. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement. The measuring device may have several measurements or derived values available in different channels. Use the channel number to define the variable that the AI block processes.

The AI block supports alarming, signal scaling, signal filtering, signal status calculation, mode control, and simulation. In Automatic mode, the block's output parameter (OUT) reflects the process variable (PV) value and status. In Manual mode, OUT may be set manually. The Manual mode is reflected on the output status. A discrete output (OUT_D) is provided to indicate whether a selected alarm condition is active. Alarm detection is based on the OUT value and user specified alarm limits. Table 7-19 lists the AI block parameters and their units of measure, descriptions, and index numbers.

Table 7-19. Definitions of Analog Input Function Block System Parameters

Parameter	Index Number	Units	Description
ACK_OPTION	23	None	Used to set auto acknowledgment of alarms.
ALARM_HYS	24	Percent	The amount the alarm value must return within the alarm limit before the associated active alarm condition clears.
ALARM_SEL	38	None	Used to select the process alarm conditions that will cause the OUT_D parameter to be set.
ALARM_SUM	22	None	The summary alarm is used for all process alarms in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
ALERT_KEY	04	None	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
BLOCK_ALM	21	None	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	06	None	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
CHANNEL	15	None	The CHANNEL value is used to select the measurement value. Refer to the appropriate device manual for information about the specific channels available in each device. You must configure the CHANNEL parameter before you can configure the XD_SCALE parameter.
FIELD_VAL	19	Percent	The value and status from the transducer block or from the simulated input when simulation is enabled.
GRANT_DENY	12	None	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by device.
HI_ALM	34	None	The HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.
HI_HI_ALM	33	None	The HI HI alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.
HI_HI_LIM	26	EU of PV_SCALE	The setting for the alarm limit used to detect the HI HI alarm condition.
HI_HI_PRI	25	None	The priority of the HI HI alarm.
HI_LIM	28	EU of PV_SCALE	The setting for the alarm limit used to detect the HI alarm condition.
HI_PRI	27	None	The priority of the HI alarm.
IO_OPTS	13	None	Allows the selection of input/output options used to alter the PV. Low cutoff enabled is the only selectable option.
L_TYPE	16	None	Linearization type. Determines whether the field value is used directly (Direct), is converted linearly (Indirect), or is converted with the square root (Indirect Square Root).
LO_ALM	35	None	The LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.
LO_LIM	30	EU of PV_SCALE	The setting for the alarm limit used to detect the LO alarm condition.
LO_LO_ALM	36	None	The LO LO alarm data, which includes a value of the alarm, a timestamp of occurrence and the state of the alarm.
LO_LO_LIM	32	EU of PV_SCALE	The setting for the alarm limit used to detect the LO LO alarm condition.
LO_LO_PRI	31	None	The priority of the LO LO alarm.
LO_PRI	29	None	The priority of the LO alarm.
LOW_CUT	17	%	If percentage value of transducer input fails below this, PV = 0.

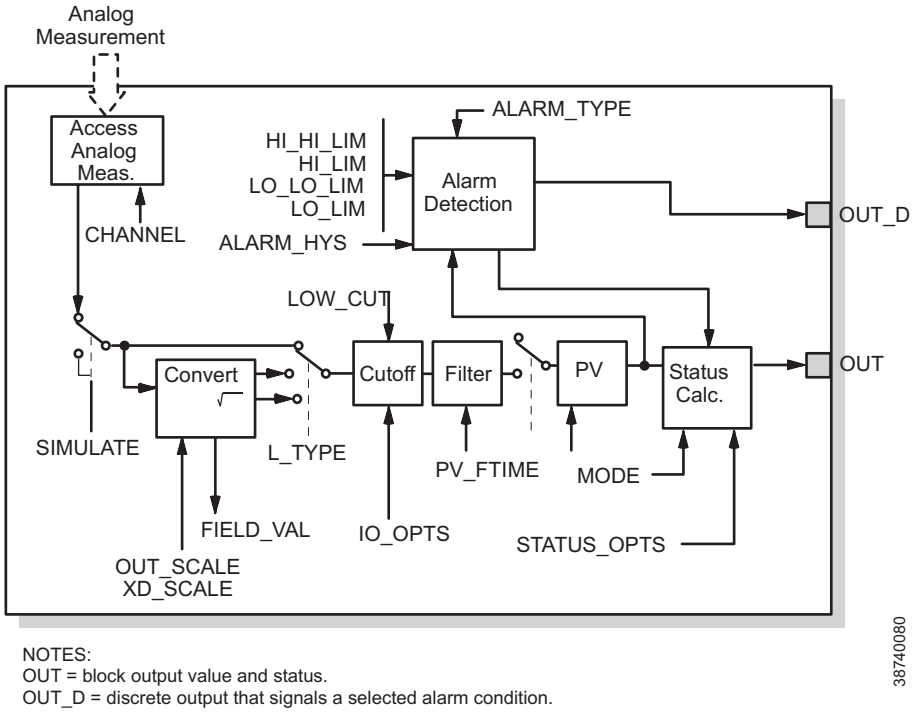
Parameter	Index Number	Units	Description
MODE_BLK	05	None	The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
OUT	08	EU of OUT_SCALE	The block output value and status.
OUT_D	37	None	Discrete output to indicate a selected alarm condition.
OUT_SCALE	11	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with OUT.
PV	07	EU of XD_SCALE	The process variable used in block execution.
PV_FTIME	18	Seconds	The time constant of the first-order PV filter. It is the time required for a 63% change in the IN value.
SIMULATE	09	None	A group of data that contains the current transducer value and status, the simulated transducer value and status, and the enable/disable bit.
STRATEGY	03	None	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
ST_REV	01	None	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
TAG_DESC	02	None	The user description of the intended application of the block.
UPDATE_EVT	20	None	This alert is generated by any change to the static data.
VAR_INDEX	39	% of OUT Range	The average absolute error between the PV and its previous mean value over that evaluation time defined by VAR_SCAN.
VAR_SCAN	40	Seconds	The time over which the VAR_INDEX is evaluated.
XD_SCALE	10	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the channel input value. The XD_SCALE units code must match the units code of the measurement channel in the transducer block. If the units do not match, the block will not transition to MAN or AUTO.

Simulation

To support testing, you can either change the mode of the block to manual and adjust the output value, or you can enable simulation through the configuration tool and manually enter a value for the measurement value and its status.

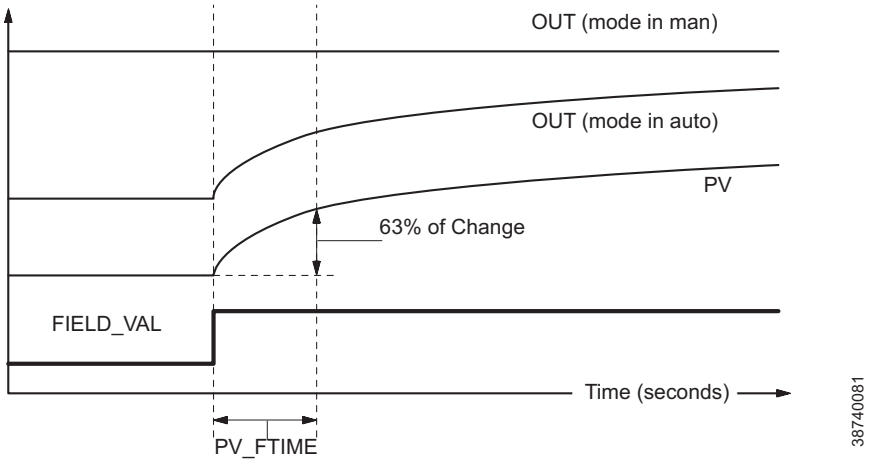
With simulation enabled, the actual measurement value has no impact on the OUT value or the status.

Figure 7-6. Analog Input Function Block Schematic



NOTES:
OUT = block output value and status.
OUT_D = discrete output that signals a selected alarm condition.

Figure 7-7. Analog Input Function Block Timing Diagram



Filtering

The filtering feature changes the response time of the device to smooth variations in output readings caused by rapid changes in input. You can adjust the filter time constant (in seconds) using the PV_FTIME parameter. Set the filter time constant to zero to disable the filter feature.

Signal Conversion

You can set the signal conversion type with the Linearization Type (L_TYPE) parameter. You can view the converted signal (in percent of XD_SCALE) through the FIELD_VAL parameter.

$$FIELD\_VAL = \frac{100 \times (Channel\ Value - EU^*@0\%)}{(EU^*@100\% - EU^*@0\%)}$$

* XD_SCALE values

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You can choose from direct, indirect, or indirect square root signal conversion with the L_TYPE parameter.

Direct

Direct signal conversion allows the signal to pass through the accessed channel input value (or the simulated value when simulation is enabled).

PV = Channel Value

Indirect

Indirect signal conversion converts the signal linearly to the accessed channel input value (or the simulated value when simulation is enabled) from its specified range (XD_SCALE) to the range and units of the PV and OUT parameters (OUT_SCALE).

$$PV = \left(\frac{FIELD\_VAL}{100}\right) x\ (EU^{**}@100\% - EU^{**}@0\%) + EU^{**}@0\%$$

** OUT_SCALE values

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Indirect Square Root

Indirect Square Root signal conversion takes the square root of the value computed with the indirect signal conversion and scales it to the range and units of the PV and OUT parameters.

$$PV = \sqrt{\left(\frac{FIELD\_VAL}{100}\right)} x\ (EU^{**}@100\% - EU^{**}@0\%) + EU^{**}@0\%$$

** OUT_SCALE values

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When the converted input value is below the limit specified by the LOW_CUT parameter, and the Low Cutoff I/O option (IO_OPTS) is enabled (True), a value of zero is used for the converted value (PV). This option is useful to eliminate false readings when the differential pressure measurement is close to zero, and it may also be useful with zero-based measurement devices such as flowmeters.

NOTE
Low Cutoff is the only I/O option supported by the AI block. You can set the I/O option in **Manual** or **Out of Service** mode only.

Block Errors

Table 7-20 lists conditions reported in the BLOCK_ERR parameter. Conditions in *italics* are inactive for the AI block and are given here only for your reference.

Table 7-20. BLOCK_ERR Conditions

Condition Number	Condition Name and Description
0	Other
1	Block Configuration Error: the selected channel carries a measurement that is incompatible with the engineering units selected in XD_SCALE, the L_TYPE parameter is not configured, or CHANNEL = zero.
2	Link Configuration Error
3	Simulate Active: Simulation is enabled and the block is using a simulated value in its execution.
4	Local Override
5	Device Fault State Set
6	Device Needs Maintenance Soon
7	Input Failure/Process Variable has Bad Status: The hardware is bad, or a bad status is being simulated.
8	Output Failure: The output is bad based primarily upon a bad input.
9	Memory Failure
10	Lost Static Data
11	Lost NV Data
12	Readback Check Failed
13	Device Needs Maintenance Soon
14	Power Up
15	Out of Service: The actual mode is out of service.

Modes

The AI Function Block supports three modes of operation as defined by the MODE_BLK parameter:

- **Manual (Man)** The block output (OUT) may be set manually.
- **Automatic (Auto)** OUT reflects the analog input measurement or the simulated value when simulation is enabled.
- **Out of Service (O/S)** The block is not processed. FIELD_VAL and PV are not updated and the OUT status is set to Bad: Out of Service. The BLOCK_ERR parameter shows Out of Service. In this mode, you can make changes to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set. The types of block error for the AI block are defined above.

Process Alarm detection is based on the OUT value. You can configure the alarm limits of the following standard alarms:

- High (HI_LIM)
- High high (HI_HI_LIM)
- Low (LO_LIM)
- Low low (LO_LO_LIM)

In order to avoid alarm chattering when the variable is oscillating around the alarm limit, an alarm hysteresis in percent of the PV span can be set using the ALARM_HYS parameter. The priority of each alarm is set in the following parameters:

- HI_PRI
- HI_HI_PRI
- LO_PRI
- LO_LO_PRI

Alarms are grouped into five levels of priority:

Priority Number	Priority Description
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator.
2	An alarm condition with a priority of 2 is reported to the operator, but does not require operator attention (such as diagnostics and system alerts).
3-7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
10-15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

Status Handling

Normally, the status of the PV reflects the status of the measurement value, the operating condition of the I/O card, and any active alarm condition. In Auto mode, OUT reflects the value and status quality of the PV. In Man mode, the OUT status constant limit is set to indicate that the value is a constant and the OUT status is *Good.*

The **Uncertain** - EU range violation status is always set, and the PV status is set high- or low-limited if the sensor limits for conversion are exceeded.

In the STATUS_OPTS parameter, you can select from the following options to control the status handling:

BAD if Limited – sets the OUT status quality to Bad when the value is higher or lower than the sensor limits.

Uncertain if Limited – sets the OUT status quality to Uncertain when the value is higher or lower than the sensor limits.

Uncertain if in Manual mode – The status of the Output is set to Uncertain when the mode is set to Manual.

NOTE
The instrument must be in **Manual** or **Out of Service** mode to set the status option.

NOTE
The AI block only supports the **BAD if Limited** option. Unsupported options are not grayed out; they appear on the screen in the same manner as supported options.

Advanced Features

The AI function block provided with Fisher-Rosemount fieldbus devices provides added capability through the addition of the following parameters:

ALARM_TYPE – Allows one or more of the process alarm conditions detected by the AI function block to be used in setting its OUT_D parameter.

OUT_D – Discrete output of the AI function block based on the detection of process alarm condition(s). This parameter may be linked to other function blocks that require a discrete input based on the detected alarm condition.

VAR_SCAN – Time period in seconds over which the variability index (VAR_INDEX) is computed.

VAR_INDEX – Process variability index measured as the integral of average absolute error between PV and its mean value over the previous evaluation period. This index is calculated as a percent of OUT span and is updated at the end of the time period defined by VAR_SCAN.

Application Information

The configuration of the AI function block and its associated output channels depends on the specific application. A typical configuration for the AI block involves the following parameters:

Channel

If the device supports more than one measurement, verify that the selected channel contains the appropriate measurement or derived value.

L_TYPE

Select **Direct** when the measurement is already in the engineering units that you want for the block output.

Select **Indirect** when you want to convert the measured variable into another, for example, pressure into level or flow into energy.

Select **Indirect Square Root** when the block I/O parameter value represents a flow measurement made using differential pressure, and when square root extraction is not performed by the transducer.

Scaling

XD_SCALE provides the range and units of the measurement and **OUT_SCALE** provides the range and engineering units of the output.

Application Examples

Temperature Transmitter

Situation

A temperature transmitter with a range of –200 to 450°C.

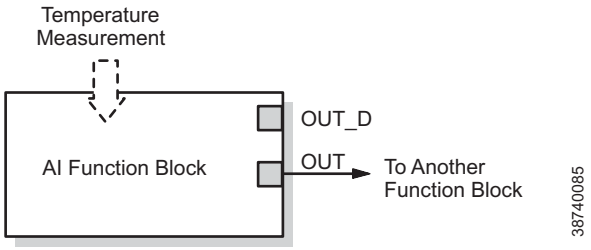
Solution

Table 7-21 lists the appropriate configuration settings, and Figure 7-8 illustrates the correct function block configuration.

Table 7-21. Analog Input Function Block Configuration for a Typical Temperature Transmitter

Parameter	Configured Values
L_TYPE	Direct
XD_SCALE	Not Used
OUT_SCALE	Not Used

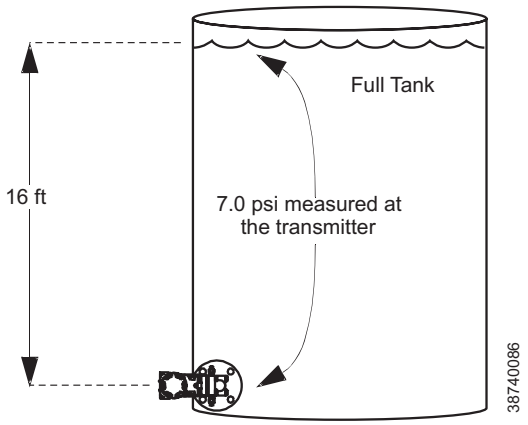
Figure 7-8. Analog Input Function Block Configuration for a Typical Temperature Transmitter



Pressure Transmitter used to Measure Level in an Open Tank

Situation #1
The level of an open tank is to be measured using a pressure tap at the bottom of the tank. The level measurement will be used to control the level of liquid in the tank. The maximum level at the tank is 16 ft. The liquid in the tank has a density that makes the level correspond to a pressure of 7.0 psi at the pressure tap (Figure 7-9).

Figure 7-9. Situation #1 Diagram

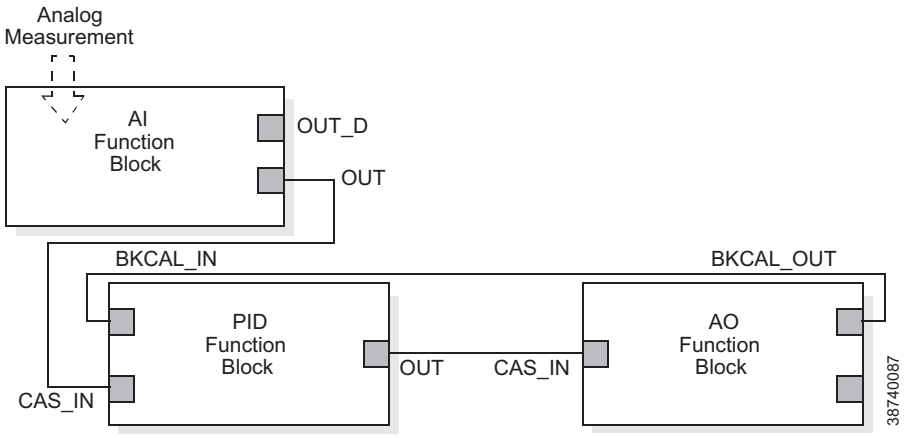


Solution to Situation #1
Table 7-22 lists the appropriate configuration settings, and Figure 7-9 illustrates the correct function block configuration.

Table 7-22. Analog Input Function Diagram for a Pressure Transmitter used in Level Measurement (Situation #1)

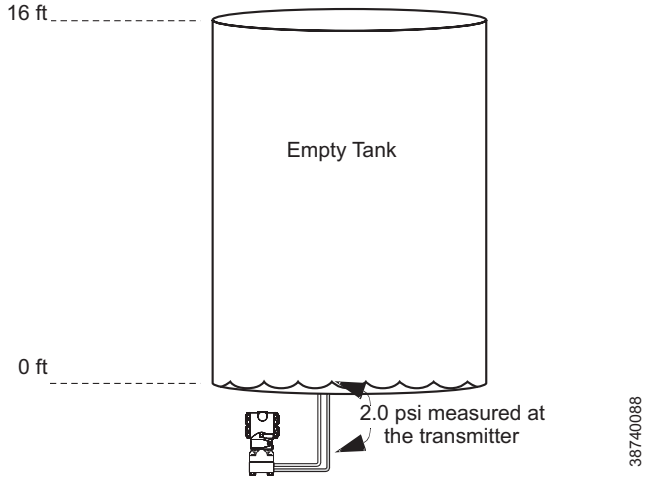
Parameter	Configured Values
L_TYPE	Indirect
XD_SCALE	0 to 7 psi
OUT_SCALE	0 to 16 ft

Figure 7-10. Function Block Diagram for a Pressure Transmitter used in Level Measurement



Situation #2
The transmitter in situation #1 is installed below the tank in a position where the liquid column in the impulse line, when the tank is empty, is equivalent to 2.0 psi (Figure 7-11).

Figure 7-11. Situation #2 Diagram



Solution
Table 7-23 lists the appropriate configuration settings.

Table 7-23. Analog Input Function Diagram for a Pressure Transmitter used in Level Measurement (Situation #2)

Parameter	Configured Values
L_TYPE	Indirect
XD_SCALE	2 to 9 psi
OUT_SCALE	0 to 16 ft

Differential Pressure Transmitter to Measure Flow

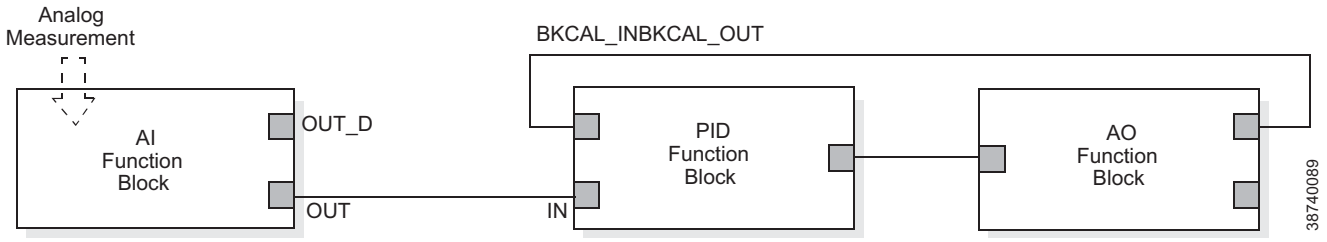
Situation
The liquid flow in a line is to be measured using the differential pressure across an orifice plate in the line, and the flow measurement will be used in a flow control loop. Based on the orifice specification sheet, the differential pressure transmitter was calibrated for 0 to 20 in H_20 for a flow of 0 to 800 gal/min, and the transducer was not configured to take the square root of the differential pressure.

Solution
Table 7-24 lists the appropriate configuration settings, and Figure 7-12 illustrates the correct function block configuration.

Table 7-24. Analog Input Function Block Configuration for a Differential Pressure Measurement

Parameter	Configured Values
L_TYPE	Indirect Square Root
XD_SCALE	0 to 20 in.
OUT_SCALE	0 to 800 gal/min

Figure 7-12. Function Block Diagram for a Differential Pressure Transmitter Used in a Flow Measurement



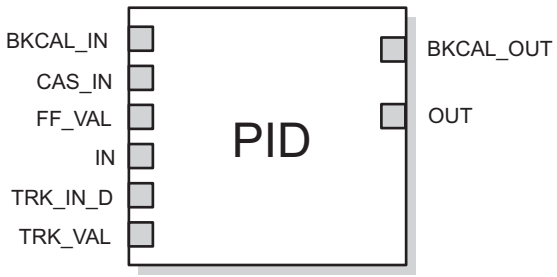
Troubleshooting

Refer to Table 7-25 to troubleshoot any problems that you encounter.

Table 7-25. Troubleshooting

Symptom	Possible Cause	Corrective Action
Mode will not leave OOS	1. Target mode not set	1. Set target mode to something other than OOS.
	2. Configuration error	2. BLOCK_ERR will show the configuration error bit set. The following are parameters that must be set before the block is allowed out of OOS: a. CHANNEL must be set to a valid value and cannot be left at initial value of 0. b. XD_SCALE.UNITS_INDX must match the units in the transducer block channel value. c. L_TYPE must be set to Direct, Indirect, or Indirect Square Root and cannot be left at initial value of 0.
	3. Resource block	3. The actual mode of the Resource block is OOS. See Resource Block Diagnostics for corrective action.
	4. Schedule	4. Block is not scheduled and therefore cannot execute to go to Target Mode. Schedule the block to execute.
Process and/or block alarms will not work	1. Features	1. FEATURES_SEL does not have Alerts enabled. Enable the Alerts bit.
	2. Notification	2. LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY.
	3. Status Options	3. STATUS_OPTS has Propagate Fault Forward bit set. This should be cleared to cause an alarm to occur.
Value of output does not make sense	1. Linearization Type	1. Does not make L_TYPE must be set to Direct, Indirect, or Indirect Square Root and cannot be left at initial value 0.
	2. Scaling	2. Scaling parameters are set incorrectly: a. XD_SCALE.EU0 and EU100 should match that of the transducer block channel value. b. OUT_SCALE.EU0 and EU100 are not set properly.
Cannot Set HI_LIMIT, HI_HI_LIMIT LO_LIMIT, or LO_LO_LIMIT Values	1. Scaling	1. Limit values are outside the OUT_SCALE.EU0 and OUT_SCALE.EU100 values. Change OUT_SCALE or set values within range.

PROPORTIONAL/ INTEGRAL/DERIVATIVE (PID) FUNCTION BLOCK



BKCAL_IN = The analog input value and status from another block's BKCAL_OUT output that is used for backward output tracking for bumpless transfer and to pass limit status.

CAS_IN = The remote setpoint value from another function block.

FF_VAL = The feedforward control input value and status.

IN = The connection for the process variable from another function block.

TRK_IN_D = Initiates the external tracking function.

TRK_VAL = The value after scaling applied to OUT in Local Override mode.

BKCAL_OUT = The value and status required by the BKCAL_IN input of another function block to prevent reset windup and to provide bumpless transfer to closed loop control.

OUT = The block output and status.

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The PID function block combines all of the necessary logic to perform proportional/integral/derivative (PID) control. The block supports mode control, signal scaling and limiting, feedforward control, override tracking, alarm limit detection, and signal status propagation.

The block supports two forms of the PID equation: Standard and Series. You can choose the appropriate equation using the FORM parameter. The Standard ISA PID equation is the default selection.

$$\text{Standard Out} = \text{GAIN} \times e \times \left(1 + \frac{1}{\tau_r s + 1} + \frac{\tau_d s}{\tau_d s + 1}\right) + F$$

$$\text{Series Out} = \text{GAIN} \times e \times \left[\left(1 + \frac{1}{\tau_r s}\right) + \left(\frac{\tau_d s + 1}{\alpha \times \tau_d s + 1}\right)\right] + F$$

Where

GAIN: proportional gain value
τ_r: Integral action time constant (RESET parameter) in seconds
s: laplace operator
d: derivative action time constant (RATE parameter)
α: fixed smoothing factor of 0.1 applied to RATE
F: feedforward control contribution from the feedforward input (FF_VAL parameter)
e: error between setpoint and process variable

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To further customize the block for use in your application, you can configure filtering, feedforward inputs, tracking inputs, setpoint and output limiting, PID equation structures, and block output action. Table 7-26 lists the PID block parameters and their descriptions, units of measure, and index numbers, and Figure 7-13 illustrates the internal components of the PID function block.

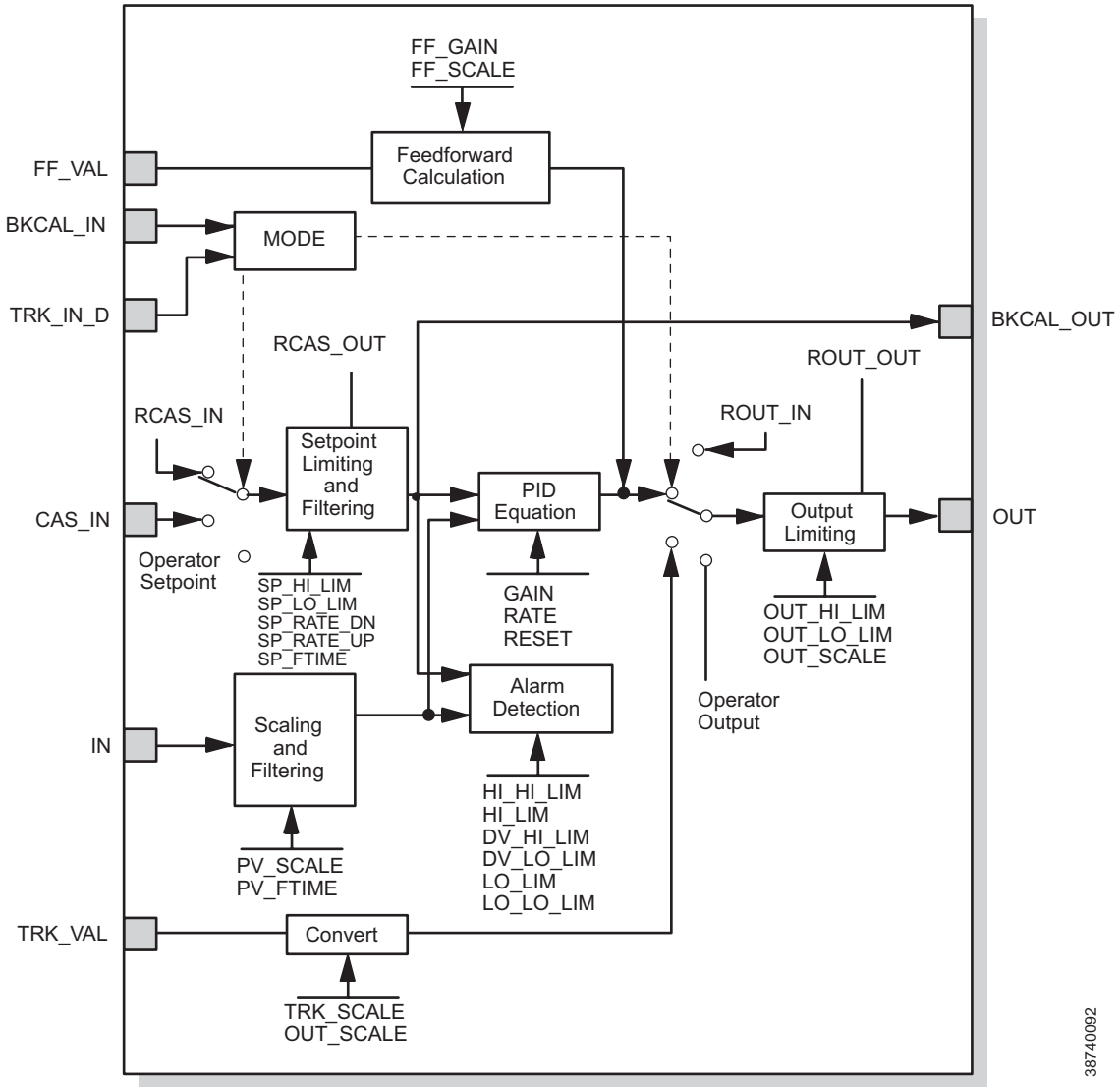
Table 7-26. PID Function Block System Parameters

Parameter	Index Number	Units	Description
ACK_OPTION	46	None	Used to set auto acknowledgment of alarms.
ALARM_HYS	47	Percent	The amount the alarm value must return to within the alarm limit before the associated active alarm condition clears.
ALARM_SUM	45	None	The summary alarm is used for all process alarms in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
ALERT_KEY	04	None	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
ALG_TYPE	74	None	Selects filtering algorithm as Backward or Bilinear.
BAL_TIME	25	Seconds	The specified time for the internal working value of bias to return to the operator set bias. Also used to specify the time constant at which the integral term will move to obtain balance when the output is limited and the mode is AUTO, CAS, or RCAS.
BIAS	66	EU of OUT_SCALE	The bias value used to calculate output for a PD type controller.
BKCAL_HYS	30	Percent	The amount the output value must change away from the its output limit before limit status is turned off.
BKCAL_IN	27	EU of OUT_SCALE	The analog input value and status from another block's BKCAL_OUT output that is used for backward output tracking for bumpless transfer and to pass limit status.
BKCAL_OUT	31	EU of PV_SCALE	The value and status required by the BKCAL_IN input of another block to prevent reset windup and to provide bumpless transfer of closed loop control.
BLOCK_ALM	44	None	The block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the active status in the status parameter. As soon as the Unreported status is cleared by the alert reporting task, and other block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	06	None	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string so that multiple errors may be shown.
BYPASS	17	None	Used to override the calculation of the block. When enabled, the SP is sent directly to the output.
CAS_IN	18	EU of PV_SCALE	The remote setpoint value from another block.
CONTROL_OPTS	13	None	Allows you to specify control strategy options. The supported control options for the PID block are Track enable, Track in Manual, SP-PV Track in Man, SP-PV Track in LO or IMAN, Use PV for BKCAL OUT, and Direct Acting.
CONTROL_OPTS	13	None	Allows you to specify control strategy options. The supported control options for the PID block are Track enable, Track in Manual, SP-PV Track in Man, SP-PV Track in LO or IMAN, Use PV for BKCAL OUT, and Direct Acting.
DV_HI_ALM	64	None	The DV HI alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
DV_HI_LIM	57	EU of PV_SCALE	The setting for the alarm limit used to detect the deviation high alarm condition.
DV_HI_PRI	56	None	The priority of the deviation high alarm.
DV_LO_ALM	65	None	The DV LO alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
DV_LO_LIM	59	EU of PV_SCALE	The setting for the alarm limit use to detect the deviation low alarm condition.
DV_LO_PRI	58	None	The priority of the deviation low alarm.
ERROR	67	EU of PV_SCALE	The error (SP-PV) used to determine the control action.
FF_ENABLE	70	None	Enables the use of feedforward calculations.

Parameter	Index Number	Units	Description
FF_GAIN	42	None	The feedforward gain value. FF_VAL is multiplied by FF_GAIN before it is added to the calculated control output.
FF_SCALE	41	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the feedforward value (FF_VAL).
FF_VAL	40	EU of FF_SCALE	The feedforward control input value and status.
GAIN	23	None	The proportional gain value. This value cannot = 0.
GRANT_DENY	12	None	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by the device.
HI_ALM	61	None	The HI alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
HI_HI_ALM	60	None	The HI HI alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
HI_HI-LIM	49	EU of PV_SCALE	The setting for the alarm limit used to detect the HI HI alarm condition.
HI_HI_PRI	48	None	The priority of the HI HI Alarm.
HI_LIM	51	EU of PV_SCALE	The setting for the alarm limit used to detect the HI alarm condition.
HI_PRI	50	None	The priority of the HI alarm.
IN	15	EU of PV_SCALE	The connection for the PV input from another block.
LO_ALM	62	None	The LO alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
LO_LIM	53	EU of PV_SCALE	The setting for the alarm limit used to detect the LO alarm condition.
LO_LO_ALM	63	None	The LO LO alarm data, which includes a value of the alarm, a timestamp of occurrence, and the state of the alarm.
LO_LO_LIM	55	EU of PV_SCALE	The setting for the alarm limit used to detect the LO LO alarm condition.
LO_LO_PRI	54	None	The priority of the LO LO alarm.
LO_PRI	52	None	The priority of the LO alarm.
MATH_FORM	73	None	Selects equation form (series or standard).
MODE_BLK	05	None	The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
OUT	09	EU of OUT SCALE	The block input value and status.
OUT_HI_LIM	28	EU of OUT_SCALE	The maximum output value allowed.
OUT-LO_LIM	29	EU of OUT_SCALE	The minimum output value allowed.
OUT_SCALE	11	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with OUT.
PV	07	EU of PV_SCALE	The process variable used in block execution.
PV_FTIME	16	Seconds	The time constant of the first-order PV filter. It is the time required for a 63 percent change in the IN value.
PV_SCALE	10	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with PV.
RATE	26	Seconds	The derivative action time constant.
RCAS_IN	32	EU of PV_SCALE	Target setpoint and status that is provided by a supervisory host. Used when mode is RCAS.
RCAS_OUT	35	EU of PV_SCALE	Block setpoint and status after ramping, filtering, and limiting that is provided to a supervisory host for back calculation to allow action to be taken under limiting conditions or mode change. Used when mode is RCAS.
RESET	24	Seconds per repeat	The integral action time constant.
ROUT_IN	33	EU of OUT_SCALE	Target output and status that is provided by a supervisory host. Used when mode is ROUT.

Parameter	Index Number	Units	Description
ROUT_OUT	36	EU of OUT_SCALE	Block output that is provided to a supervisory host for a back calculation to allow action to be taken under limiting conditions or mode change. Used when mode is RCAS.
SHED_OPT	34	None	Defines action to be taken on remote control device time-out.
SP	08	EU of PV_SCALE	The target block setpoint value. It is the result of setpoint limiting and setpoint rate of change limiting.
SP_FTIME	69	Seconds	The time constant of the first-order SP filter. It is the time required for a 63 percent change in the IN value.
SP_HI_LIM	21	EU of PV_SCALE	The highest SP value allowed.
SP_LO_LIM	22	EU of PV_SCALE	The lowest SP value allowed.
SP_RATE_DN	19	EU of PV_SCALE per second	Ramp rate for downward SP changes. When the ramp rate is set to zero, the SP is used immediately.
SP-RATE_UP	20	EU of PV_SCALE per second	Ramp rate for upward SP changes. When the ramp rate is set to zero, the SP is used immediately.
SP_WORK	68	EU of PV_SCALE	The working setpoint of the block after limiting and filtering is applied.
STATUS_OPTS	14	None	Allows you to select options for status handling and processing. The supported status option for the PID block is Target to Manual if Bad IN.
STRATEGY	03	None	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
ST_REV	01	None	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
STRUCTURE CONFIG	75	None	Defines PID equation structure to apply controller action.
TAG_DESC	02	None	The user description of the intended application of the block.
TRK_IN_D	38	None	Discrete input that initiates external tracking.
TRK_SCALE	37	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with the external tracking value (TRK_VAL).
TRK_VAL	39	EU of TRK SCALE	The value (after scaling from TRK_SCALE to OUT_SCALE) applied to OUT in LO mode.
UBETA	72	Percent	Used to set disturbance rejection vs. tracking response action for a 2.0 degree of freedom PID.
UGAMMA	71	Percent	Used to set disturbance rejection vs. tracking response action for a 2.0 degree of freedom PID.
UPDATE_EVT	43	None	This alert is generated by any changes to the static data.

Figure 7-13. PID Function Block Schematic



Setpoint Selection and Limiting

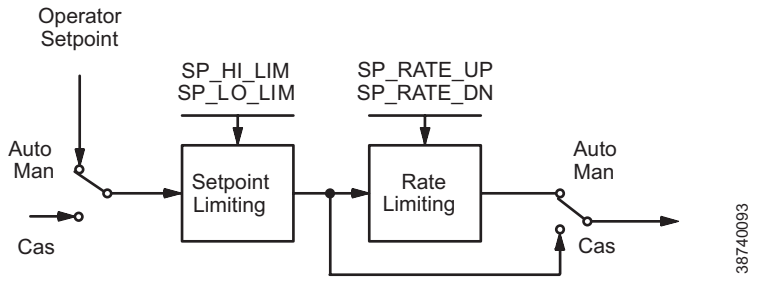
The setpoint of the PID block is determined by the mode. You can configure the SP_HI_LIM and SP_LO_LIM parameters to limit the setpoint. In **Cascade** or **RemoteCascade** mode, the setpoint is adjusted by another function block or by a host computer, and the output is computed based on the setpoint.

In **Automatic** mode, the setpoint is entered manually by the operator, and the output is computed based on the setpoint. In Auto mode, you can also adjust the setpoint limit and the setpoint rate of change using the SP_RATE_UP and SP_RATE_DN parameters.

In **Manual** mode the output is entered manually by the operator, and is independent of the setpoint. In **RemoteOutput** mode, the output is entered by a host computer, and is independent of the setpoint.

Figure 7-14 illustrates the method for setpoint selection.

Figure 7-14. PID Function Block Setpoint Selection



Filtering

The filtering feature changes the response time of the device to smooth variations in output readings caused by rapid changes in input. You can configure the filtering feature with the FILTER_TYPE parameter, and you can adjust the filter time constant (in seconds) using the PV_FTIME or SP_FTIME parameters. Set the filter time constant to zero to disable the filter feature.

Feedforward Calculation

The feedforward value (FF_VAL) is scaled (FF_SCALE) to a common range for compatibility with the output scale (OUT_SCALE). A gain value (FF_GAIN) is applied to achieve the total feedforward contribution.

Tracking

You enable the use of output tracking through the control options. You can set control options in Manual or Out of Service mode only.

The **Track Enable** control option must be set to *True* for the track function to operate. When the Track in Manual control option is set to *True*, tracking can be activated and maintained only when the block is in **Manual** mode. When **Track in Manual** is *False*, the operator can override the tracking function when the block is in **Manual** mode. Activating the track function causes the block's actual mode to revert to **Local Override**.

The TRK_VAL parameter specifies the value to be converted and tracked into the output when the track function is operating. The TRK_SCALE parameter specifies the range of TRK_VAL.

When the TRK_IN_D parameter is *True* and the **Track Enable** control option is *True*, the TRK_VAL input is converted to the appropriate value and output in units of OUT_SCALE.

Output Selection and Limiting

Output selection is determined by the mode and the setpoint. In **Automatic**, **Cascade**, or **RemoteCascade** mode, the output is computed by the PID control equation. In **Manual** and **RemoteOutput** mode, the output may be entered manually. You can limit the output by configuring the OUT_HI_LIM and OUT_LO_LIM parameters.

Bumpless Transfer and Setpoint Tracking

You can configure the method for tracking the setpoint by configuring the following control options (CONTROL_OPTS):

SP-PV Track in Man — Permits the SP to track the PV when the target mode of the block is Man.

SP-PV Track in LO or IMan — Permits the SP to track the PV when the actual mode of the block is Local Override (LO) or Initialization Manual (IMan).

When one of these options is set, the SP value is set to the PV value while in the specified mode.

You can select the value that a master controller uses for tracking by configuring the **Use PV for BKCAL_OUT** control option. The BKCAL_OUT value tracks the PV value. BKCAL_IN on a master controller connected to BKCAL_OUT on the PID block in an open cascade strategy forces its OUT to match BKCAL_IN, thus tracking the PV from the slave PID block into its cascade input connection (CAS_IN). If the **Use PV for BKCAL_OUT** option is not selected, the working setpoint (SP_WRK) is used for BKCAL_OUT.

You can set control options in **Manual** or **Out of Service** mode only. When the mode is set to **Auto**, the SP will remain at the last value (it will no longer follow the PV.

PID Equation Structures

Configure the STRUCTURE parameter to select the PID equation structure. You can select one of the following choices:

- PI Action on Error, D Action on PV
- PID Action on Error
- I Action on Error, PD Action on PV

Set RESET to zero to configure the PID block to perform integral only control regardless of the STRUCTURE parameter selection. When RESET equals zero, the equation reduces to an integrator equation with a gain value applied to the error:

$$\frac{GAIN \times e(s)}{s}$$

Where

GAIN: proportional gain value
e: error
s: laplace operator

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Reverse and Direct Action

To configure the block output action, enable the **Direct Acting** control option. This option defines the relationship between a change in PV and the corresponding change in output. With **Direct Acting** enabled (True), an increase in PV results in an increase in the output.

You can set control options in **Manual** or **Out of Service** mode only.

NOTE
Track Enable, Track in Manual, SP-PV Track in Man, SP-PV Track in LO or IMan, Use PV for BKCAL_OUT, and **Direct Acting** are the only control options supported by the PID function block. Unsupported options are not grayed out; they appear on the screen in the same manner as supported options.

Reset Limiting

The PID function block provides a modified version of feedback reset limiting that prevents windup when output or input limits are encountered, and provides the proper behavior in selector applications.

Block Errors

Table 7-27 lists conditions reported in the BLOCK_ERR parameter. Conditions in *italics* are inactive for the PID block and are given here only for your reference.

Table 7-27. BLOCK _ERR Conditions

Condition Number	Condition Name and Description
0	Other
1	Block Configuration Error: The BY_PASS parameter is not configured and is set to 0, the SP_HI_LIM is less than the SP_LO_LIM, or the OUT_HI_LIM is less than the OUT_LO_LIM.
2	Link Configuration Error
3	Simulate Active
4	Local Override: The actual mode is LO.
5	Device Fault State Set
6	Device Needs Maintenance Soon
7	Input Failure/Process Variable has Bad Status: The parameter linked to IN is indicating a Bad status.
8	Output Failure
9	Memory Failure
10	Lost Static Data
11	Lost NV Data
12	Readback Check Failed
13	Device Needs Maintenance Now
14	Power Up
15	Out of Service: The actual mode is out of service.

Modes

The PID function block supports the following modes:

Manual (Man)—The block output (OUT) may be set manually.

Automatic (Auto)—The SP may be set manually and the block algorithm calculates OUT.

Cascade (Cas)—The SP is calculated in another block and is provided to the PID block through the CAS_IN connection.

RemoteCascade (RCas)—The SP is provided by a host computer that writes to the RCAS_IN parameter.

RemoteOutput (Rout)—The OUT is provided by a host computer that writes to the ROUT_IN parameter.

Local Override (LO)—The track function is active. OUT is set by TRK_VAL. The BLOCK_ERR parameter shows Local override.

Initialization Manual (IMan)—The output path is not complete (for example, the cascade-to-slave path might not be open). In IMan mode, OUT tracks BKCAL_IN.

Out of Service (O/S)—The block is not processed. The OUT status is set to *Bad: Out of Service*. The BLOCK_ERR parameter shows Out of service.

You can configure the Man, Auto, Cas, and O/S modes as permitted modes for operator entry.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set. The types of block error for the AI block are defined above.

Process alarm detection is based on the PV value. You can configure the alarm limits of the following standard alarms:

- High (HI_LIM)
- High high (HI_HI_LIM)
- Low (LO_LIM)
- Low low (LO_LO_LIM)

Additional process alarm detection is based on the difference between SP and PV values and can be configured via the following parameters:

- Deviation high (DV_HI_LIM)
- Deviation low (DV_LO_LIM)

In order to avoid alarm chattering when the variable is oscillating around the alarm limit, an alarm hysteresis in percent of the PV span can be set using the ALARM_HYS parameter. The priority of each alarm is set in the following parameters:

- HI_PRI
- HI_HI_PRI
- LO_PRI
- LO_LO_PRI
- DV_HI_PRI
- DV_LO_PRI

Alarms are grouped into five levels of priority:

Priority Number	Priority Description
0	The priority of an alarm condition changes to after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator.
2	An alarm condition with a priority of 2 is reported to the operator, but does not require operator attention (such as diagnostics and system alerts).
3-7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
10-15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

Status Handling

If the input status on the PID block is Bad, the mode of the block reverts to **Manual**. In addition, you can select the **Target to Manual if Bad IN** status option to direct the target mode to revert to manual. You can set the status option in **Manual** or **Out of Service** mode only.

NOTE
Target to Manual if Bad IN is the only status option supported by the PID function block. Unsupported options are not grayed out; they appear on the screen in the same manner as supported options.

Application Information

The PID function block is a powerful, flexible control algorithm that is designed to work in a variety of control strategies. The PID block is configured differently for different applications. The following examples describe the use of the PID block for closed-loop control (basic PID loop), feedforward control, cascade control with master and slave, and complex cascade control with override.

Closed Loop Control

To implement basic closed loop control, compute the error difference between the process variable (PV) and setpoint (SP) values and calculate a control output signal using a PID (Proportional Integral Derivative) function block.

The proportional control function responds immediately and directly to a change in the PV or SP. The proportional term **GAIN** applies a change in the loop output based on the current magnitude of the error multiplied by a gain value.

The integral control function reduces the process error by moving the output in the appropriate direction. The integral term **RESET** applies a correction based on the magnitude and duration of the error. Set the RESET parameter to zero for integral only control. To reduce reset action, configure the RESET parameter to be a large value.

The derivative term **RATE** applies a correction based on the anticipated change in error. Derivative control is typically used in temperature control where large measurement lags exist.

The MODE parameter is a switch that indicates the target and actual mode of operation. Mode selection has a large impact on the operation of the PID block:

- **Manual** mode allows the operator to set the value of the loop output signal directly.
- **Automatic** mode allows the operator to select a setpoint for automatic correction of error using the **GAIN, RESET,** and **RATE** tuning values.
- **Cascade** and **Remote Cascade** modes use a setpoint from another block in a cascaded configuration.
- **Remote Out** mode is similar to **Manual** mode except that the block output is supplied by an external program rather than by the operator.
- **Initialization Manual** is a non-target mode used with cascade configurations while transitioning from manual operation to automatic operation.

- **Local Override** is a non-target mode that instructs the block to revert to Local Override when the tracking or fail-safe control options are activated.
- **Out of Service** mode disables the block for maintenance.

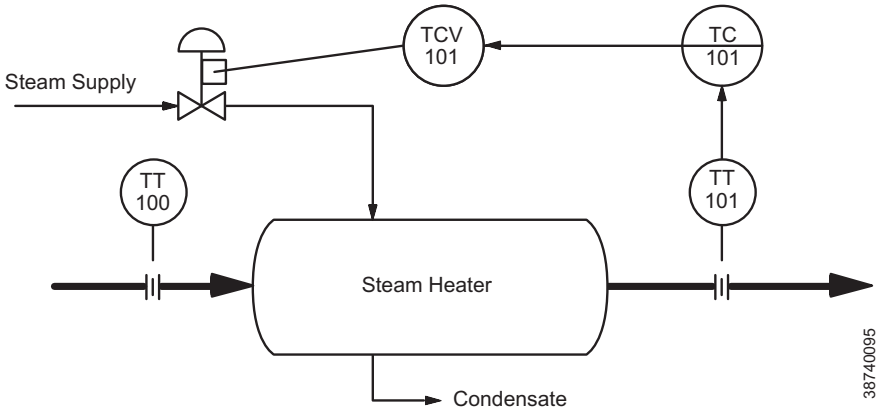
Abrupt changes in the quality of the input signal can result in unexpected loop behavior. To prevent the output from changing abruptly and upsetting the process, select the **SP-PV Track in Man** I/O option. This option automatically sets the loop to **Manual** if a *Bad* input status is detected. While in manual mode, the operator can manage control manually until a Good input status is reestablished.

Application Examples

Basic PID Block for Steam Heater Control

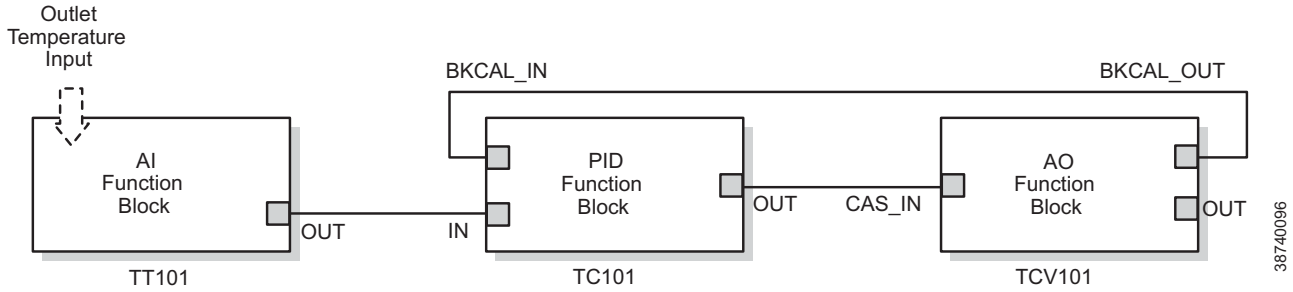
Situation
A PID block is used with an AI block and an AO block to control the flow steam used to heat a process fluid in a heat exchanger. Figure 7-15 illustrates the process instrumentation diagram.

Figure 7-15. PID Function Block Steam Heater Control



Solution
The PID loop uses TT101 as an input and provides a signal to the analog output TCV101. The BKCAL_OUT of the AO block and the BKCAL_IN of the PID block communicate the status and quality of information being passed between the blocks. The status indication shows that communications is functioning and the I/O is working properly. Figure 7-16 illustrates the correct function block configuration.

Figure 7-16. PID Function Block Diagram for Steam Heater Control Example



Feedforward Control

Situation
In the previous example, control problems can arise because of a time delay caused by thermal inertia between the two flow streams (TT100 and TT101). Variations in the inlet temperature (TT100) take an excessive amount of time to be sensed in the outlet (TT101). This delay causes the product to be out of the desired temperature range.

Solution
Feedforward control is added to improve the response time of the basic PID control. The temperature of the inlet process fluid (TT100) is input to an AI function block and is connected to the FF_VAL connector on the PID block. Feedforward control is then enabled (FF_ENABLE), the feedforward value is scaled (FF_SCALE), and a gain (FF_GAIN) is determined. Figure 7-17 illustrates the process instrumentation diagram, and Figure 7-18 illustrates the correct function block configuration.

Figure 7-17. PID Function Block Feedforward Control Example

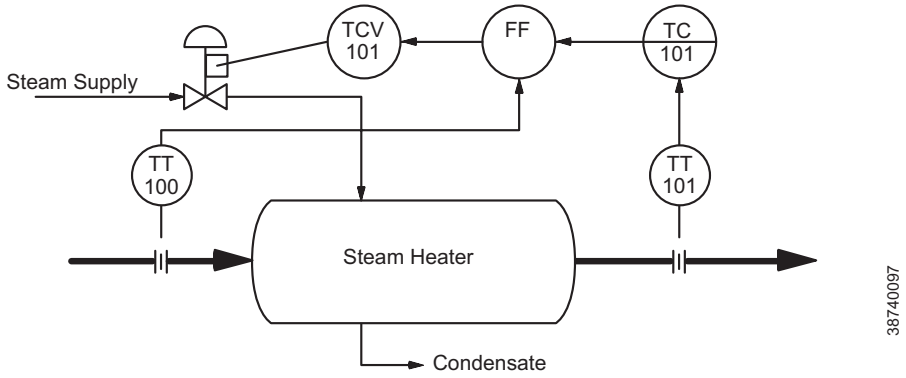
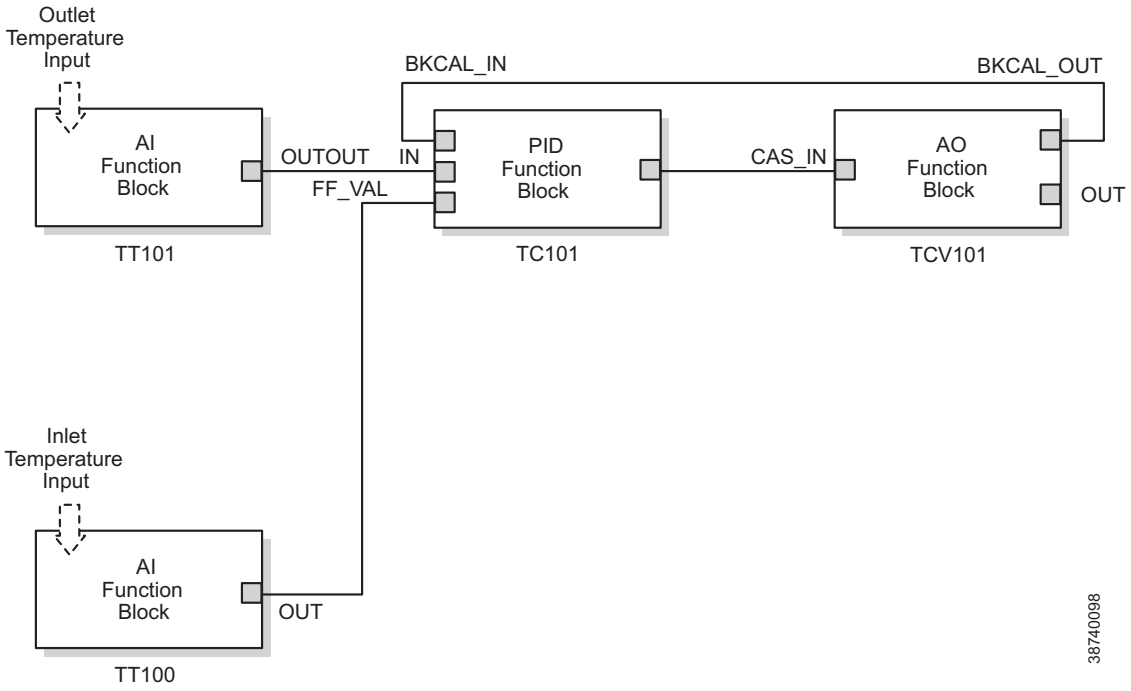


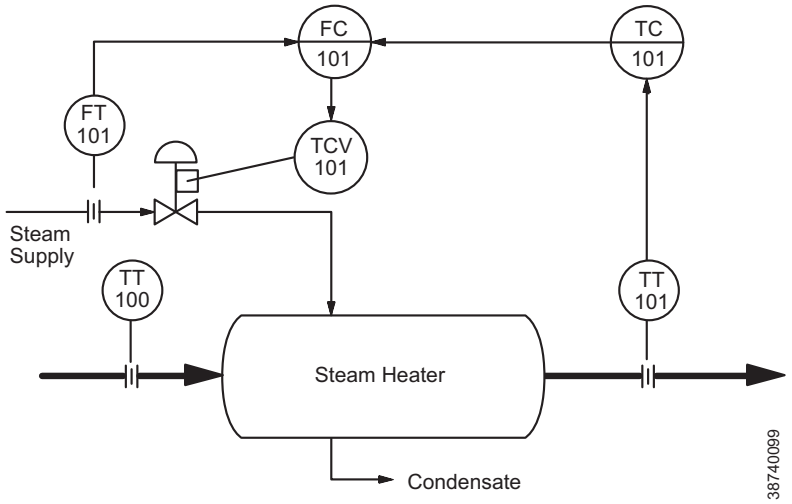
Figure 7-18. PID Function Block Diagram for Feedfoward Control



Cascade Control with Master and Slave Loops

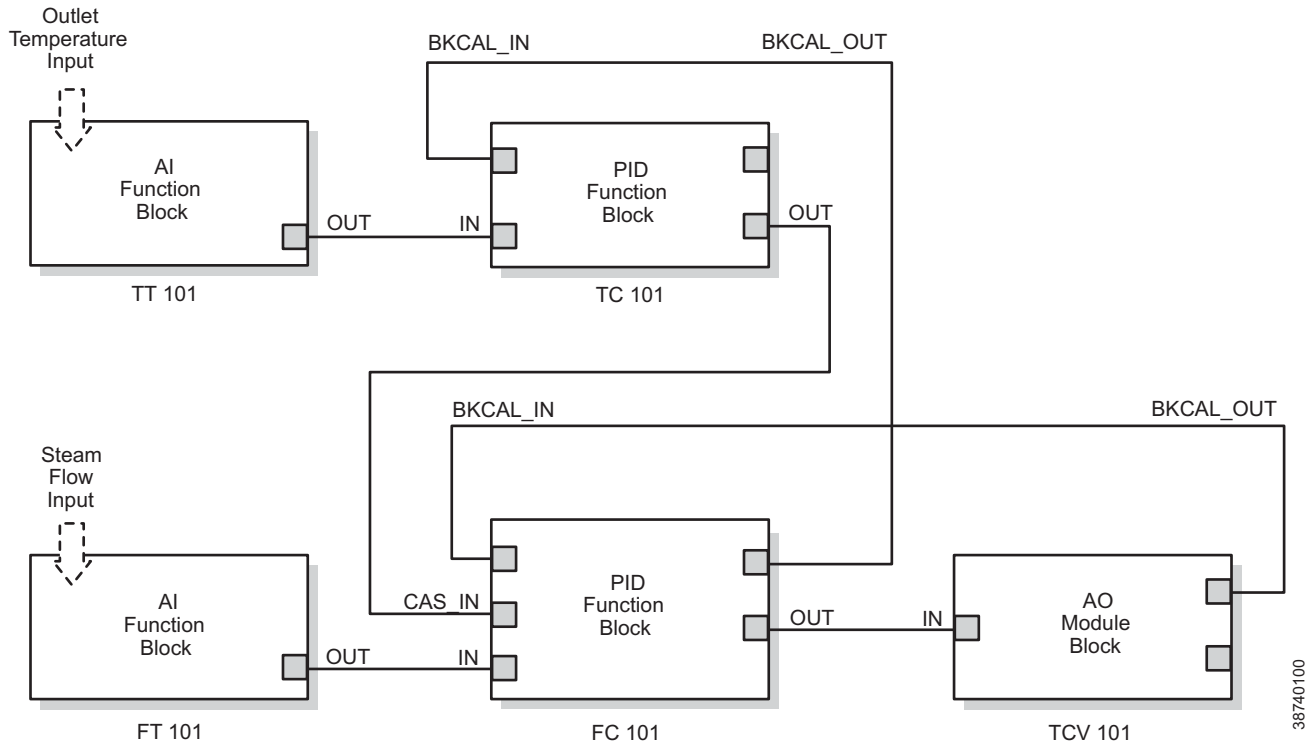
Situation
A slave loop is added to a basic PID control configuration to measure and control steam flow to the steam heater. Variations in the steam pressure cause the temperature in the heat exchanger to change. The temperature variation will later be sensed by TT101. The temperature controller will modify the valve position to compensate for the steam pressure change. The process is slow and causes variations in the product temperature. Figure 7-19 illustrates the process instrumentation diagram.

Figure 7-19. PID Function Block Cascade Control Example



Solution
If the flow is controlled, steam pressure variations will be compensated before they significantly affect the heat exchanger temperature. The output from the master temperature loop is used as the setpoint for the slave steam flow loop. The BKCAL_IN and BKCAL_OUT connections on the PID blocks are used to prevent controller windup on the master loop when the slave loop is in Manual or Automatic mode, or it has reached an output constraint. Figure 7-20 illustrates the correct function block configuration.

Figure 7-20. PID Function Block Diagram for Cascade Control Example



Cascade Control with Override

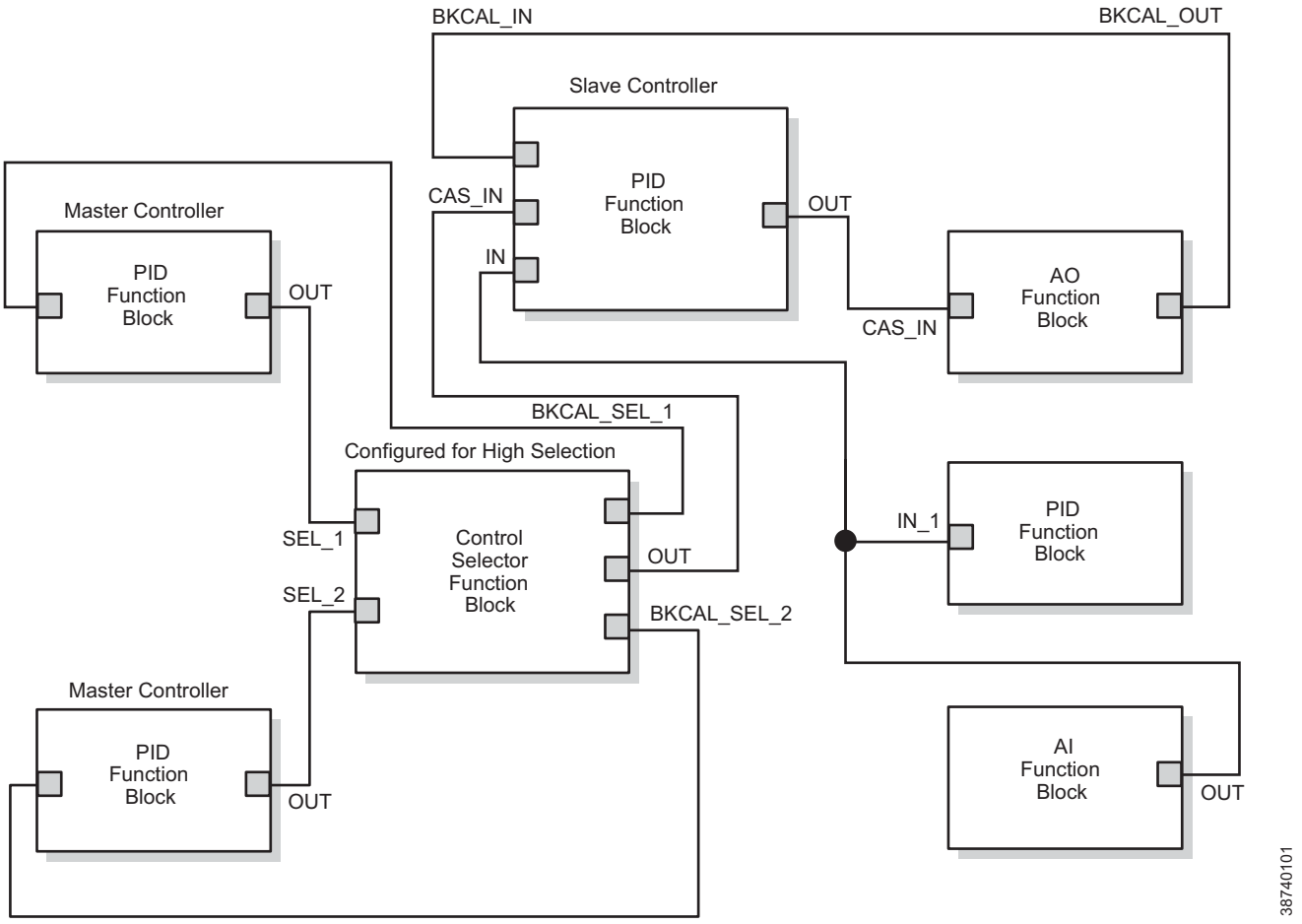
You can use the PID function block with other function blocks for complex control strategies. Figure 7-21 illustrates the function block diagram for cascade control with override.

When configured for cascade control with override, if one of the PID function blocks connected to the selector inputs is deselected, that PID block filters the integral value to the selected value (the value at its BKCAL_IN). The selected PID block behaves normally and the deselected controller never winds up. At steady state, the deselected PID block offsets its OUT value from the selected value by the proportional term. When the selected block becomes output-limited, it prevents the integral term from winding further into the limited region.

When the cascade between the slave PID block and the Control Selector block is open, the open cascade status is passed to the Control Selector block and through to the PID blocks supplying input to it. The Control Selector block and the upstream (master) PID blocks have an actual mode of **IMan**.

If the instrument connected to the AI block fails, you can place the AI block in **Manual** mode and set the output to some nominal value for use in the Integrator function block. In this case, IN at the slave PID block is constant and prevents the integral term from increasing or decreasing.

Figure 7-21. Function Block Diagram for Cascade Control with Override



Troubleshooting

Refer to Table 7-28 to troubleshoot any problems that you encounter.

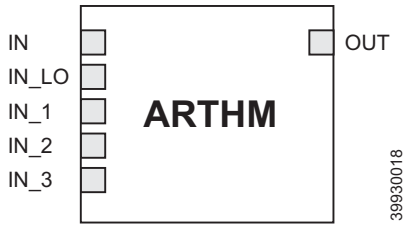
Table 7-28. Troubleshooting

Symptom	Possible Causes	Corrective Action
Mode will not leave OOS	1. Target mode not set	1. Set target mode to something other than OOS.
	2. Configuration error	2. BLOCK_ERR will show the configuration error bit set. The following are parameters that must be set before the block is allowed out of OOS: a. BYPASS must be off or on and cannot be left at initial value of 0. b. OUT_HI_LIM must be less than or equal to OUT_LO_LIM. c. SP_HI_LIM must be less than or equal to SP_LO_LIM.
	3. Resource block	3. The actual mode of the Resource block is OOS. See Resource Block Diagnostics for corrective action.
	4. Schedule	4. Block is not scheduled and therefore cannot execute to go to Target Mode. Schedule the block to execute.
Mode will not leave IMAN	1. Back Calculation	1. BKCAL_IN a. The link is not configured (the status would show “Not Connected”).Configure the BKCAL_IN link to the downstream block. b. The downstream block is sending back a Quality of “Bad” or a Status of “Not Invited”. See the appropriate downstream block diagnostics for corrective action.
Mode will not change to AUTO	1. Target mode not set	1. Set target mode to something other than OOS.
	2. Input	2. IN a. The link is not configured (the status would show “Not Connected”). Configure the IN link to the block. b. The upstream block is sending back a Quality of “Bad” or a Status of “Not Invited”. See the appropriate upstream block diagnostics for corrective action.
Mode will not change to CAS	1. Target mode not set	1. Set target mode to something other than OOS.
	2. Cascade Input	2. CAS_IN a. The link is not configured (the status would show “Not Connected”). Configure the CAS_IN link to the block. b. The upstream block is sending back a Quality of “Bad” or a Status of “Not Invited”. See the appropriate up stream block diagnostics for corrective action.

Symptom	Possible Causes	Corrective Action
Mode sheds from RCAS to AUTO	1. Remote Cascade Value	1. Host system is not writing RCAS_IN with a quality and status of “good cascade” within shed time (see 2 below).
	2. Shed Timer	2. The mode shed timer, SHED_RCAS in the resource block is set too low. Increase the value.
Mode sheds from ROUT to MAN	1. Remote output value	1. Host system is not writing ROUT_IN with a quality and status of “good cascade” within shed time (see 2 below).
	2. Shed timer	2. The mode shed timer, SHED_RCAS, in the resource block is set too low. Increase the value.
Process and/or block alarms will not work	1. Features	1. FEATURES_SEL does not have Alerts enabled. Enable the Alerts bit.
	2. Notification	2. LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY.
	3. Status Options	3. STATUS_OPTS has Propagate Fault Forward bit set. This should be cleared to cause an alarm to occur.

ARITHMETIC (ARTHM) FUNCTION BLOCK

Figure 7-22. Arithmetic (ARTHM) Function Block



The Arithmetic function block provides the ability to configure a range extension function for a primary input and applies the nine (9) different arithmetic types as compensation to or augmentation of the range extended input. All operations are selected by parameter and input connection.

The nine (9) arithmetic functions are Flow Compensation Linear, Flow Compensation Square Root, Flow Compensation Approximate, BTU Flow, Traditional Multiply and Divide, Average, Summer, Fourth Order Polynomial, and Simple HTG Compensate Level.

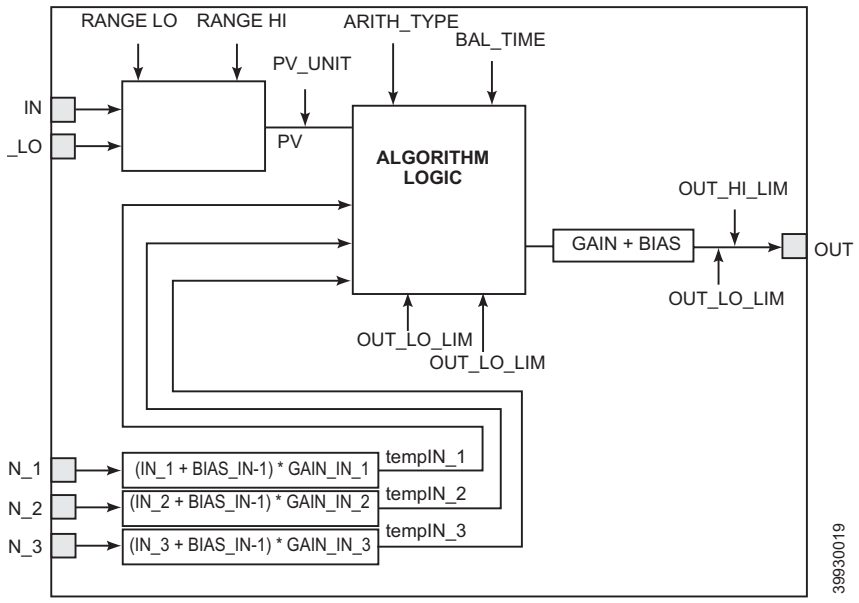
This Arithmetic function block supports mode control (Auto, Manual, Out of Service). There is no standard alarm detection in this block.

Table 7-29. Arithmetic (ARTHM) Block

Index Number	Parameter	Units	Description
4	ALERT_KEY	None	The identification number of the plant unit. This information may be used in thehost fro sorting alarms, etc.
29	ARITH_TYPE	None	The set of 9 arithmetic functions applied as compensation to or augmentation of the range extended input.
30	BAL_TIME	Seconds	Specifies the time for a block value to match an input, output, or calculated value or the time for dissipation of the internal balancing bias.
31	BIAS	None	The bias value.
21	BIAS_IN_1	None	The bias value for IN_1.
23	BIAS_IN_2	None	The bias value for IN_2.
25	BIAS_IN_3	None	The bias value for IN_3.
36	BLOCK_ALM	None	This block alarm is used for all configuration, hardware, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field.The first alert to become active will set the active status in the status parameter. As soon as the Unreported status is cleared by the alert reporting task, and other block alert may be reported without clearing the Active status, if the subcode has changed.
6	BLOCK_ERR	None	The summary of active error conditions associated with the block. The possible block errors are Block configuration error, Simulate active, Local override, Input failure/process variable has Bad status, Output failure, Readback failed, Out of service, and Other. Each function block reports none or a subset of these error conditions.
27	COMP_HI_LIM	EU of PV	Determines the high limit of the compensation input.
28	COMP_LO_LIM	EU of PV .	Determines the low limit of the compensation input.
32	GAIN	None	The proportional gain (multiplier) value.
22	GAIN_IN_1	None	The proportional gain (multiplier) value for IN_1.
24	GAIN_IN_2	None	The proportional gain (multiplier) value for IN_2.
26	GAIN_IN_3	None	The proportional gain (multiplier) value for IN_3.
12	GRANT_DENY	None	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by the device.
14	IN	Determined by source or EU of PV _SCALE	The analog input value and status. The number of inputs is an extensible parameter in some function blocks.
16	IN_1	Determined by supplying block or source.	The first analog input value and status.
17	IN_2	Determined by supplying block or source.	The second analog input value and status.
18	IN_3	Determined by supplying block or source.	The third analog input value and status.
15	IN_LO	None	The value used for the input whenever IN is below range.
13	INPUT_OPTS	None	Sets the options for using IN, IN_LO, IN_1, IN_2 and IN_3 when any are either Bad or Uncertain.
5	MODE_BLK	None	The mode record of the block. MODE contains the actual, target, permitted, and normal modes. In some function blocks, this parameter is used to request and show the source of the setpoint, the source of the output, and/or the block operating state.
8	OUT	EU of OUT_SCALE or Percent or EU of IN	The analog output value and status. The number of outputs is an extensible parameter in some blocks.
33	OUT_HI_LIM	EU of OUT_SCALE Supplied by IN	The maximum output value allowed.
34	OUT_LO_LIM	EU of OUT_RANGE or Supplied by IN	The minimum output value allowed.
11	OUT_RANGE	None	Range of the output.
9	PRE_OUT	EU of OUT	The pre-trip limit from SP or zero.
7	PV	EU of OUT or EU of PV_SCALE	The process variable used in block execution and alarm limit detection.

Index Number	Parameter	Units	Description
10	PV_SCALE	None	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with OUT.
19	RANGE_HI	None	The high limit for IN.
20	RANGE_LO	None	The low limit for IN. If IN is less than RANGE_LO, then IN_LO is used.
3	STRATEGY	None	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
1	ST_REV	None	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
2	TAG_DESC	None	The user description of the intended application of the block.
35	UPDATE_EVT	None	This alert is generated by any changes to the static data.

Figure 7-23. Arithmetic Function Block Diagram



Block Errors

Table 7-30 lists the conditions reported in the BLOCK_ERR parameter.

Table 7-30. BLOCK_ERR Parameters

Condition Number	Condition Name and Description
0	Other: The output has a quality of uncertain.
1	Block Configuration Error: Select type is not configured
2	Link Configuration Error
3	Simulate Active
4	Local Override
5	Device Fault State Set
6	Device Needs Maintenance Soon
7	Input Failure/Process Variable has Bad Status: One of the inputs is Bad or not connected.
8	Output Failure

Condition Number	Condition Name and Description
9	Memory Failure
10	Lost Static Data
11	Lost NV Data
12	Readback Check Failed
13	Device Needs Maintenance Now
14	Power Up: The device was just powered-up.
15	Out of Service: The actual mode is out of service.

Modes

The ARTHM block supports the following modes:

- **Manual** (Man) – The block output (OUT) may be set manually.
- **Automatic** (Auto) – OUT reflects the analog input measurement or the simulated value when simulation is enabled.
- **Out of Service** (O/S) – The block is not processed. FIELD_VAL and PV are not updated and the OUT status is set to Bad: Out of Service. The BLOCK_ERR parameter shows Out of Service. In this mode, you can make changes to all configurable parameters.

The target mode of a block may be restricted to one or more of the supported modes.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set. The types of block error for the ARTHM block are defined above. Alarms are grouped into five levels of priority (Table 7-31).

Table 7-31. Alarm Level Priorities

Priority Number	Priority Description
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator
2	An alarm condition with a priority of 2 is reported to the operator, but does not require operator attention (such as diagnostics and system alerts).
3-7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8-15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

Block Execution

The Arithmetic function block provides range extension and compensation through nine (9) arithmetic types.

There are two inputs (IN and IN_LO) used in calculating PV. PV is then combined with up to three inputs (IN_1, IN_2, and IN_3) through the user selected compensation function (ARITH_TYPE) to calculate the value of func. A gain is applied to func and then a bias is added to get the value PRE_OUT. In AUTO, PRE_OUT is used for OUT.

Range Extension and Calculation of PV

When both IN and IN_LO are usable, the following formula is applied to calculate range extension for PV:

$$PV = G * IN + (1 - G) * IN\_LO$$

(G has a range from 0 to 1, for IN from RANGE_LO to RANGE_HI.)

Compensation Input Calculations

For each of the inputs IN_1, IN_3, IN_4 there is a gain and bias. The compensation terms (t) are calculated as follows:

- When IN_(k) is usable: t(k) = GAIN_IN(k) * (BIAS_IN(k) + IN_(k))
- When IN_(k) is not usable, then t(k) gets the value of the last t(k) computed with a usable input.

Status Handling

IN_x Use Bad

IN_x Use Uncertain

IN_LO Use Uncertain

IN Use Uncertain

For complete descriptions of supported input options, refer to the Option Bitistring Parameter.

Application Information

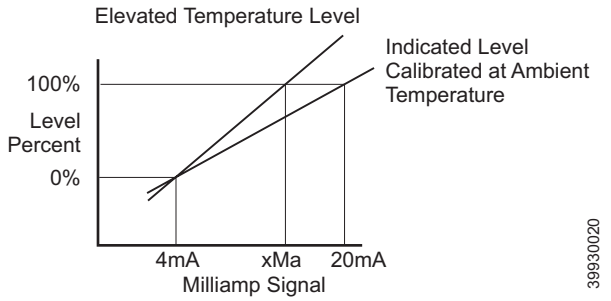
The Arithmetic function block can be used to calculate tank level changes based on greatly changing temperature conditions in devices that depend on the physical properties of the fluid.

For example, a differential pressure cell's analog input can be scaled initially to provide a 4-20 mA signal for 0-100% of level indication. As the temperature of the system rises, the density of the fluid decreases. For a system that requires accurate level indication at widely ranging temperature, changing density proves inconvenient.

The Arithmetic function block allows for the automatic compensation of this change by incorporating gain and bias adjustments to the temperature signal. It then applies both the compensated temperature signal and the level signal to a characteristic system equation. The result is a level that is a true indication of fluid in the vessel.

Different fluids over the same temperature range have different effects on level due to their thermal expansion coefficients. Vessel geometry also plays a major role. As the height of the vessel increases, the effect of thermal expansion becomes more apparent. The following figure shows the relative temperature effects on a level signal.

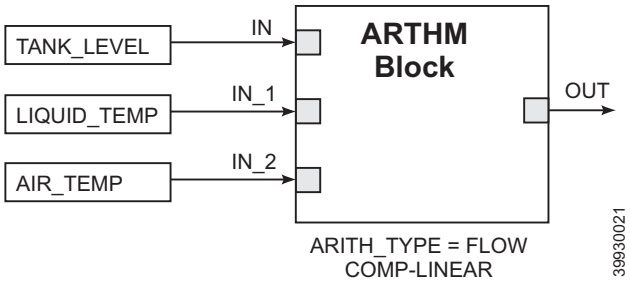
Figure 7-24. Relative Temperature Effects on Level



The calculation is done by applying the level signal to the IN connector, the liquid temperature to the IN_1 connector, and the ambient air temperature to the IN_2 connector. Select the Arithmetic type (ARITH_TYPE) of Flow Compensation - Linear.

This allows a ratio to be set up that increases the level indication at block output for an increase in the tank temperature relative to ambient temperature.

Figure 7-25. Arithmetric Function Block Diagram Example



This application can be applied to very large storage tanks whose contents are subject to thermal expansion and contraction during seasonal changes in temperature.

Advanced Topics

Arithmetic Types

The parameter ARITH_TYPE determines how PV and the compensation terms (t) are combined. User may select from nine (9) commonly used math functions, depicted below. COMP_HI and COMP_LO are compensation limits.

Flow Compensation Linear	Flow Compensation Square Root
func = PV • f COMP_HI $f = \frac{t(1)}{t(2)}$ COMP_LO	func = PV • f COMP_HI $f = \sqrt{\frac{t(1) \cdot t(3)}{t(2)}}$ COMP_LO

39930022

If there is a divide by zero and the numerator is positive, f is set to COMP_HI; if the numerator is negative, then f is set to COMP_LO.

The square root of a negative value will equal the negative of the square root of the absolute value. Imaginary roots are not supported.

Flow Compensation Approximate	BTU Flow	Traditional Multiply and Divide
func = PV • f COMP_HI $f = t(1) \cdot t(2) \cdot t(3)^2$ COMP_LO	func = PV• · f COMP_HI f = t(1) - t(2) COMP_LO	func = PV • f COMP_HI $f = \frac{t(1)}{t(2)} + t(3)$ COMP_LO

39930029

If there is a divide by zero and numerator is positive, f will be limited to COMP_HI; if the numerator is negative, f will be limited to COMP_LO. Compensation inputs which are not usable are not included in the calculation. PV is always included.

Troubleshooting

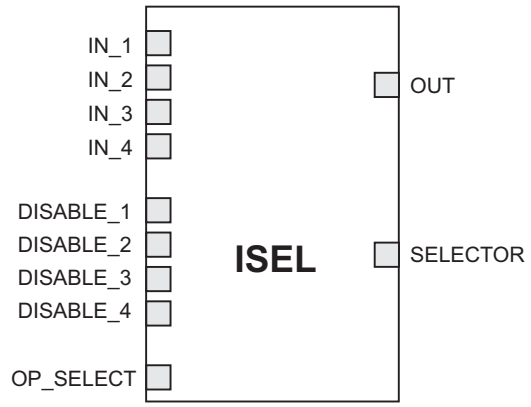
Refer to Table 7-32 to troubleshoot any problems that you encounter.

Table 7-32. Troubleshooting

Symptom	Possible Causes	Corrective Action
Model will not leave OOS	Target model not set	Set target mode to something other than OOS.
	Configuration error	BLOCK_ERR will show the configuration error set. ARITH_TYPE must be set to a valid value and cannot be left at 0.
	Resource Block	The actual mode of the Resource block is OOS. See Resource block diagnostics for corrective action.
	Schedule	Block is not scheduled and therefore cannot execute to go to the target mode. Typically, BLOCK_ERR will show “Power-Up” for all blocks that are not scheduled. Schedule the block to execute.
Status of outputs is BAD	Inputs	Input has BAD status.
Block alarms will not work	Features	FEATURES_SEL does not have Alerts enabled. Enable the Alert bit.
	Notification	LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY.
	Status Options	STATUS_OPTS has the Propagate Fault Forward bit set. This must be cleared to cause the alarm to occur.

INPUT SELECTOR (ISEL) FUNCTION BLOCK

Figure 7-26. Input Selector (ISEL) Function Block



IN (1-4) = Input used in the selection algorithm.
DISABLE (1-4) = Discrete input used to enable the associated input channel.
OP_SELECT = Input used to override algorithm.
TRK_VAL = The value after scaling applied to OUT in local channel override.
SELECTED = The selected channel number.
OUT = The block output and status.

39930024

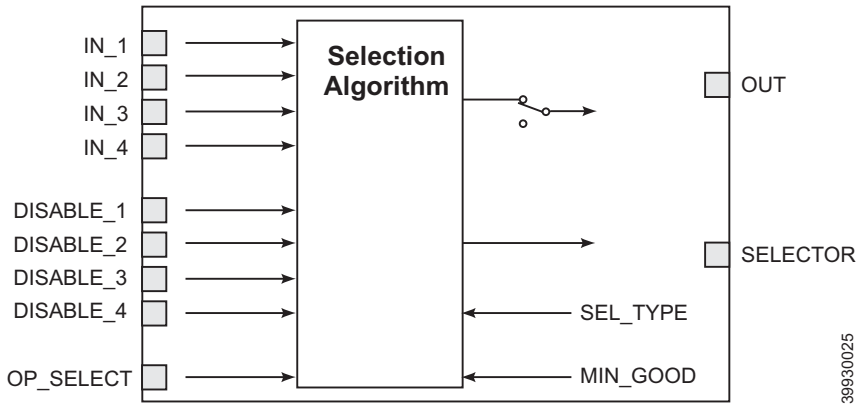
The Input Selector (ISEL) function block can be used to select the first good, Hot Backup, maximum, minimum, or average of as many as four input values and place it at the output. The block supports signal status propagation. There is no process alarm detection in the Input Selector function block.

Figure 7-28 illustrates the internal components of the ISEL block. Table 7-33 lists the ISEL block parameters and their descriptions, units of measure, and index numbers.

Table 7-33. Input Selector Function Block System Parameters

	Index Number	Units	Description
ALERT_KEY	4	None	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
BLOCK_ALM	24	None	The block alarm is used for all configuration, hardw are, connection failure, or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
BLOCK_ERR	6	None	This parameter reflects the error status associated w ith the hardw are or software components associated with a block. It is a bit string, so that multiple errors may be shown.
DISABLE_1	15	None	A Connection from another block that disables the associated input fromthe selection.
DISABLE_2	16	None	A Connection from another block that disables the associated input fromthe selection.
DISABLE_3	17	None	A Connection from another block that disables the associated input fromthe selection.
DISABLE_4	18	None	A Connection from another block that disables the associated input fromthe selection.
GRANT_DENY	9	None	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by device.
IN_1	11	Determined by source	The connection input from another block. One of the inputs to be selected from.
IN_2	12	Determined by source	The connection input from another block. One of the inputs to be selected from.
IN_3	13	Determined by source	The connection input from another block. One of the inputs to be selected from.
IN_4	14	Determined by source	The connection input from another block. One of the inputs to be selected from.
MIN_GOOD	20	None	The minimum number of good inputs The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allow ed modes that target may take on Normal: Most common mode for target.
OP_SELECT	22	None	Overrides the algorithm to select 1 of the 4 inputs regardless of the selection type.
OUT	7	EU of IN	The block output value and status.
OUT_UNITS	8	None	The engineering units of the output. Typically, all inputs have the same units and the value is also the same.
SELECTED	21	None	The selected input number (1–4).
SELECT_TYPE	19	None	Specifies selection method (see Block Execution).
STATUS_OPTS	10	None	Allows selection of options for status handling and processing. The supported status option for the PID block is Target to Manual if Bad IN.
STRATEGY	3	None	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
	1	None	The revision level of the static data associated w ith the function block. The revision value w ill be incremented each time a static parameter value in the block is changed.
TAG_DESC	2	None	The user description of the intended application of the block.
	23	None	This alert is generated by any change to the static data.

Figure 7-27. Input Selector Function Block Schematic



Block Errors

Table 7-34 lists the conditions reported in the BLOCK_ERR parameter. Conditions in *italics* are inactive for the ISEL block and are listed for reference only.

Table 7-34. Block Error Conditions

Condition Number	Condition Name and Description
0	Other: The output has a quality of uncertain.
1	Block Configuration Error
2	Link Configuration Error
3	Simulate Active
4	Local Override: The actual mode is LO.
5	Device Fault State Set
6	Device Needs Maintenance Soon
7	Input Failure/Process Variable has Bad Status: One of the inputs is Bad or not connected.
8	Output Failure: The output has the quality of Bad.
9	Memory Failure: A memory failure has occurred in FLASH, RAM, or EEROM memory.
10	Lost Static Data
11	Lost NV Data
12	Readback Check Failed
13	Device Needs Maintenance Now
14	Power Up: The device w as just pow ered-up.
15	Out of Service: The actual mode is out of service.

Modes

The ISEL function block supports three modes of operation as defined by the MODE_BLK parameter:

- **Manual (Man)** The block output (OUT) may be set manually.
- **Automatic (Auto)** OUT reflects the selected value.
- **Out of Service (O/S)** The block is not processed. The BLOCK_ERR parameter shows Out of Service. In this mode, changes caNn be made to all configurable parameters. The target mode of a block may be restricted to one or more of the supported modes.

Alarm Detection

A block alarm will be generated whenever the BLOCK_ERR has an error bit set. The types of block error for the ISEL block are defined above.

Alarms are grouped into five levels of priority, Table 7-35.

Table 7-35. Alarm Priorities

Priority	Priority Description Number
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator.
2	An alarm condition with a priority of 2 is reported to the operator, but does not require operator attention (such as diagnostics and system alerts).
3 to 7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8 to 15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

Block Execution

The ISEL function block reads the values and statuses of as many as four inputs. To specify which of the six available methods (algorithms) is used to select the output, configure the selector type parameter (SEL_TYPE) as follows:

- **max** selects the maximum value of the inputs.
- **min** selects the minimum value of the inputs.
- **avg** calculates the average value of the inputs.
- **mid** calculates the middle of three inputs or the average of the middle two inputs if four inputs are defined.
- **1st Good** selects the first available good input.
- **Hot Backup** latches on the selected input and continues to use it until it is bad.

If DISABLE_N is active, the associated input is not used in the selection algorithm.

If OP_SELECT is set to a value between 1 and 4, the selection type logic is overridden and the output value and status is set to the value and status of the input selected by OP_SELECT.

SELECTED will have the number of the selected input unless the SEL_TYPE is average, in which case it will have the number of inputs used to calculate its value.

Status Handling

In Auto mode, OUT reflects the value and status quality of the selected input. If the number of inputs with Good status is less than MIN_GOOD, the output status will be Bad.

In Man mode, the OUT status high and low limits are set to indicate that the value is a constant and the OUT status is always Good.

In the STATUS_OPTS parameter, the following options can be selected from to control the status handling:

- **Use Uncertain as Good:** sets the OUT status quality to Good when the selected input status is Uncertain.
- **Uncertain if in Manual mode:** The status of the Output is set to Uncertain when the mode is set to manual.

⚠CAUTION

The instrument must be in Manual or Out of Service mode to set the status option.

Application Information

The ISEL function block can be used to select the maximum temperature input from four inputs and send it to a PID function block to control a process water chiller (Table 7-28) or it can use the block to calculate the average temperature of the four inputs (Table 7-29).

Figure 7-28. Input Selector Function Block Application Example (SEL_TYPE = max).

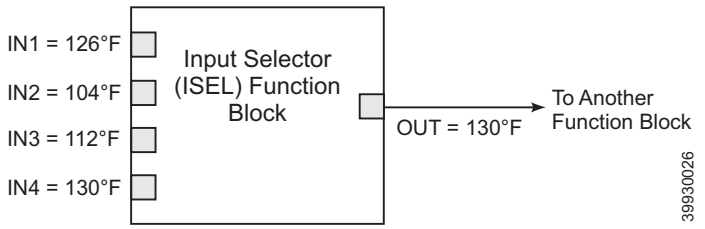


Figure 7-29. Input Selector Function Block Application Example (SEL_TYPE = avg.).

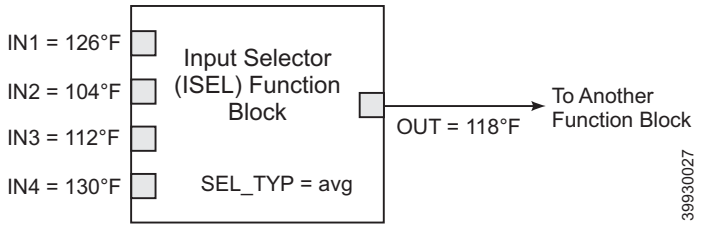


Figure 7-30. Input Selector Function Block Application Example (SEL_TYPE = Hot Backup)

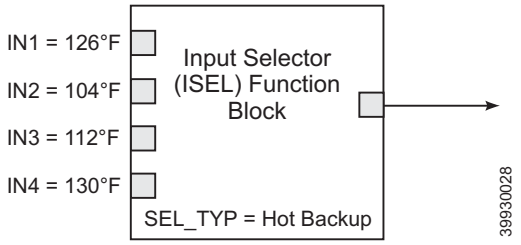


Table 7-36. Input Selector Function Blocks

	IN1		IN2		Out		Selected	
Time	Value	Status	Value	Status	Value	Status	Value	Status
T_0	Good	20	Good	21	Good	20	Good	1
T_1	Bad	20	Good	21	Good	21	Good	2
T_2	Good	20	Good	21	Good	21	Good	2

Troubleshooting

Table 7-37. Troubleshooting ISEL Block

Symptom	Possible Causes	Corrective Action
Mode w= ill not leave OOS	1. Target mode not set	1. Set target mode to something other than OOS.
	2. Configuration error	2. BLOCK_ERR will show the configuration error bit set. SELECT_TYPE must be set to a valid value and cannot be left at 0.
	3. Resource block	3. The actual mode of the Resource block is OOS. See Resource Block Diagnostics for corrective action.
	4. Schedule	4. Block is not scheduled and therefore cannot execute to go to Target Mode. Schedule the block to execute.
Status of output is bad	1. Inputs	1. All inputs have Bad status.
	2. OP selected	2. OP_SELECT is not set to 0 (or it is linked to an input that is not 0), and it points to an input that is Bad.
	3. Min good	3. The number of Good inputs is less than MIN_GOOD.
Block Alarms will not work	1. Features	1. FEATURES_SEL does not have Alerts enabled. Enable Alerts bit.
	2. Notification	2. LIM_NOTIFY is not high enough. Set equal to MAX_NOTIFY.
	1. Status Options	1. STATUS_OPTS has Propagate Fault Forward bit set. This should be cleared to cause an alarm to occur.

OPERATION WITH EMERSON PROCESS MANAGEMENT DELTAV

About AMS and DeltaV Software

AMS and DeltaV software allows users to manage their instrumentation, and to perform on-line configurations of their instruments.

The ability to communicate with instruments and configure instruments on-line facilitates instrument commissioning and loop validation.

With AMS, users can also access status and diagnostic data from smart devices and monitor their performance.

AMS leverages the I/O capabilities of the control system to gather asset management data without interfering with the control system's operations. Install the Analyzer onto DeltaV™

NOTE
The following procedures assume that the DeltaV and the analyzer are installed and powered.

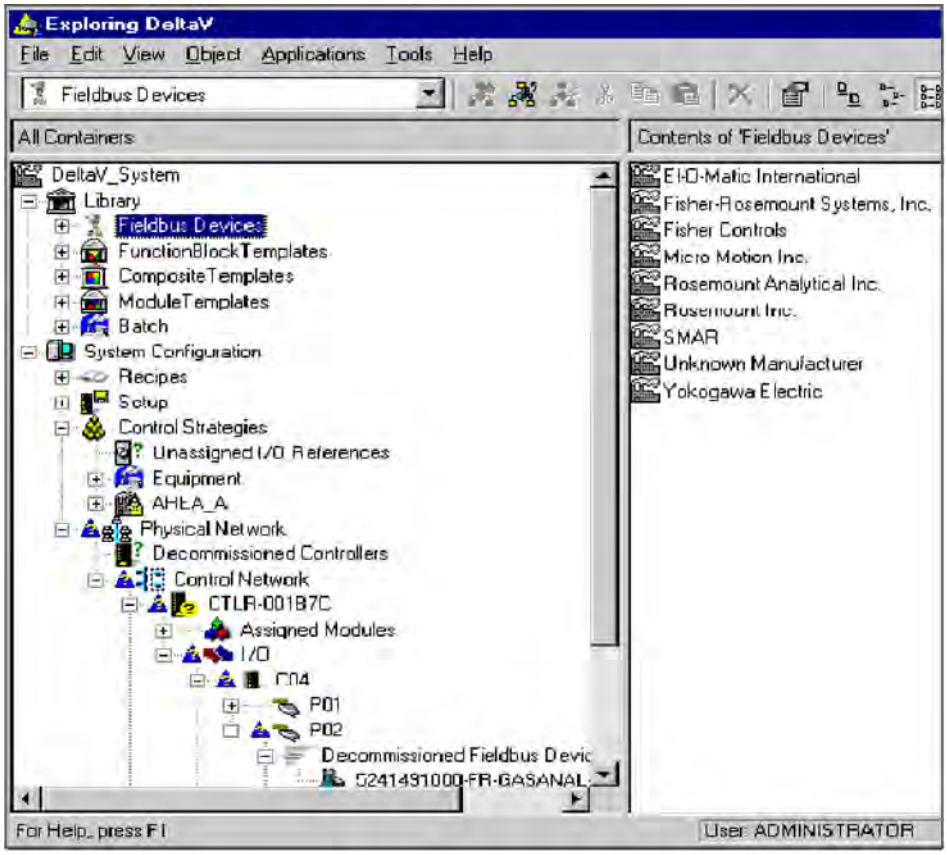
The following steps have to be performed to install a new device onto a DeltaV™ system:

- From the start menu select DeltaV > Engineering > DeltaV Explorer.
- Select/Expand "Library" (right below DeltaV_System).
- Select "Fieldbus Devices", using right mouse button. Click on "Fieldbus Devices". This will bring up a list of options.

- From the list, select “Add Device Definition”... This should give you a “Browse for folder” selection box. Browse to the directory that contains the 7 files needed to “register” a new device with DeltaV. These file will consist of 3 *.dll files, *.sym, *.ffo, *.fhx and *.reg file. The files probably will be on a floppy disk or a CD-ROM that accompanies your device. On CD-ROMs delivered together with Emerson Process Management analyzers the files are located in the directory \Fieldbus. Dependent on the existent system use the files of the appropriate subdirectory.
- After answering “yes“ to the first prompt, DeltaV will start the installation.

Figure 7-31 shows the “Exploring DeltaV“ screen for reference.

Figure 7-31. DeltaV Explorer



Section 8 Troubleshooting

Overview . . . . . **page 8-1**
Diagnostic Alarms . . . . . **page 8-2**
Fault Isolation . . . . . **page 8-3**
Alarm Relay Events . . . . . **page 8-11**

⚠WARNING

Install all protective equipment covers and safety ground leads after troubleshooting. Failure to install covers and ground leads could result in serious injury or death.

OVERVIEW

The troubleshooting section describes how to identify and isolate faults that may develop in the Hazardous Area OCX 8800. When troubleshooting the Hazardous Area OCX 8800, reference the following information.

Grounding

It is essential that adequate grounding precautions are taken when installing the system. Thoroughly check both the probe and electronics to ensure the grounding quality has not degraded during fault finding. The system provides facilities for 100% effective grounding and total elimination of ground loops.

Electrical Noise

The Hazardous Area OCX 8800 has been designed to operate in the type of environment normally found in a boiler room or control room. Noise suppression circuits are employed on all field terminations and main inputs. When fault finding, evaluate the electrical noise being generated in the immediate circuitry of a faulty system. Ensure all cable shields are connected to earth.

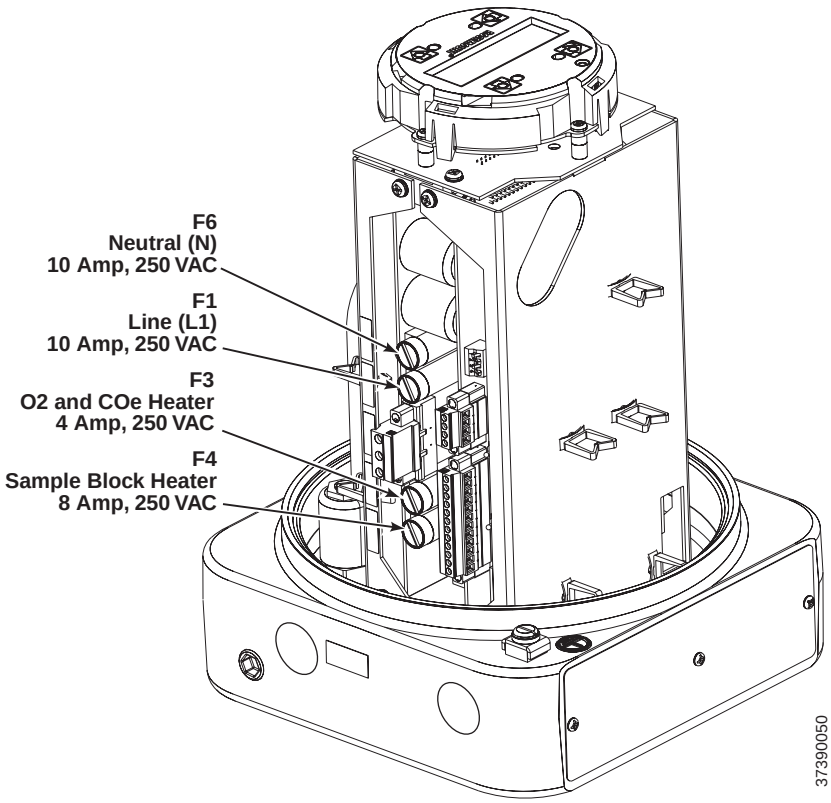
Electrostatic Discharge

Electrostatic discharge can damage ICs in the electronics. Before removing or handling the processor board or the ICs, ensure you are at ground potential.

Total Power Loss

In the event that the Hazardous Area OCX 8800 will not power up at all, check the incoming power supply to make sure power is being delivered to the Hazardous Area OCX 8800. If the incoming power supply is good, then check fuses F1 and F6 in the electronics housing. Refer to Figure 8-1 for fuse locations.

Figure 8-1. Fuse Locations



DIAGNOSTIC ALARMS

⚠CAUTION

Always install a blocking diode on the customers relay coil. Failure to install a blocking diode may create noise spikes and cause faults in the OCX electronics.

The Hazardous Area OCX 8800 is equipped with a set of alarm relay contacts on the microprocessor board in the electronics housing. This set of dry contacts can be connected to any customer supplied relay device, 30 VDC, 30 mA maximum. **A blocking diode is required on the customers relay coil.**

Any fault condition in the Hazardous Area OCX 8800 will trip the alarm relay. The optional SPA with HART programmable alarm indicates LOW O2, HIGH COe, Calibration Status, and Unit Failure. For more information, refer to Appendix B - SPA with HART Alarm.

FAULT ISOLATION

Faults in the Hazardous Area OCX 8800 Transmitter are indicated by messages displayed on the 375 Field Communicator or LOI. Fault indications that can appear are listed in Table 8-1, Troubleshooting.

If a fault is indicated on the Field Communicator or LOI, locate the fault indication in Table 8-1. For each fault listed, there are related Probable Causes and Recommended Corrective Actions. The Probable Causes are listed in the order of most probable to least probable. Starting with the most probable cause, inspect and test the unit to isolate the actual cause, then use the Recommended Corrective Action listed to correct the problem.

Table 8-1. Troubleshooting

O2 Sensor R High *(Oxygen sensor resistance high, > 5000 Ohms)* **O2 Sensor Open *(Oxygen sensor disconnected)***	
Probable Cause	**Recommended Corrective Action**
Loose or open O_2 cell circuit connection	Check O_2 cell circuit wires for breaks or loose connections. Repair lead wire break or loose connections.
O_2 cell degraded or failed	Check O_2 cell impedance by reading the O2 Snsr R value via the LOI (see Figure 4-4, sheet 2), or the O2 Snsr value via Field communicator (see Figure 6-3, sheet 1). If cell impedance is zero, replace O_2 cell with cell replacement kit. If cell impedance is less than 5000 ohms, check for cell housing ground fault. Repair ground fault. If cell impedance is greater than 5000 ohms and no ground fault is indicated, replace O_2 cell with cell replacement kit.
Ref Current Err *(RTD excitation current error) (reference current should be 5.02 mA)*	
Probable Cause	**Recommended Corrective Action**
Loose or open lead or circuit wire connection for COe sensor or CJC sensor current loop	Check all COe and CJC sensor current loop wiring per Figure 8-3 and Figure 9-9. Correct wiring faults.
COe sensor grounded	Check resistance of COe sensor leads to ground per Figure 9-9. Replace COe sensor if resistance is less than 10M Ohms.
COe sensor failed	Check resistance of both COe sensor elements per Figure 9-9. Replace COe sensor if resistance of sensor element is not between 100 and 250 Ohms.
CJC sensor grounded	Check resistance of CJC sensor to ground per Figure 9-9. Replace CJC sensor if resistance is less than 10M Ohms.
CJC sensor failed	Check resistance of CJC sensor per Figure 9-9. Replace CJC sensor if resistance of sensor is not between 100 and 150 Ohms.
O2 Temp Hi *(Oxygen sensor heater temperature high, > 750ºC)*	
Probable Cause	**Recommended Corrective Action**
High noise in OCX power supply	Check power supply for line noise or voltage fluctuations. Install power line filter kit (PN 6A00171G01) or high quality line filter for input power.
COe Temp Hi *(Combustion sensor heater temperature high, 310ºC)*	
Probable Cause	**Recommended Corrective Action**
High noise in OCX power supply	Check power supply for line noise or voltage fluctuations. Install power line filter kit (PN 6A00171G01) or high quality line filter for input power.

Table continued on next page

SB Temp Hi ***(Sample block heater temperature high, > 190ºC)***	
Probable Cause	**Recommended Corrective Action**
High noise in OCX power supply	Check power supply for line noise or voltage fluctuations. Install power line filter kit (PN 6A00171G01) or high quality line filter for input power.

O2 Temp Very Hi ***(Oxygen sensor heater over maximum temperature, > 820ºC)*** **O2 Htr Rmp Rate** ***(Oxygen sensor heater over maximum temperature ramp rate)***	
Probable Cause	**Recommended Corrective Action**
Incorrect O_2 heater wiring	Check O_2 heater wiring per Figure 8-3 and Figure 9-9. Check the wiring at the heater and inside the electronics housing. Correct wiring fault. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.
Incorrect O_2 thermocouple wiring	Check O_2 thermocouple wiring per Figure 8-3 and Figure 9-8. Check the wiring at the thermocouple and inside the electronics housing. Correct wiring fault. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.
Electronics package failure	Replace electronics package.

COe Temp Very Hi ***(Combustion sensor heater over maximum temperature, > 400ºC)*** **COe Htr Rmp Rate** ***(Combustibles sensor heater over maximum temperature ramp rate)***	
Probable Cause	**Recommended Corrective Action**
Incorrect COe heater wiring	Check COe heater wiring per Figure 8-3 and Figure 9-9. Check the wiring at the heater and inside the electronics housing. Correct wiring fault. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.
Incorrect COe thermocouple wiring	Check COe thermocouple wiring per Figure 8-3 and Figure 9-9. Check the wiring at the thermocouple and inside the electronics housing. Correct wiring fault. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.
Electronics package failure	Replace electronics package.

SB Temp Very Hi ***(Sample block heater over maximum temperature, > 260ºC)*** **SB Htr Rmp Rate** ***(Sample block heater over maximum temperature ramp rate)***	
Probable Cause	**Recommended Corrective Action**
Incorrect sample block heater wiring	Check sample block heater wiring per Figure 8-3 and Figure 9-8. Check the wiring at the heater and inside the electronics housing. Correct wiring fault. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.
Incorrect sample block thermocouple wiring	Check sample block thermocouple wiring per Figure 8-3 and Figure 9-8. Check the wiring at the thermocouple and inside the electronics housing. Correct wiring fault. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.
Electronics package failure	Replace electronics package.

O2 TC Open ***(Oxygen sensor heater thermocouple open)***	
Probable Cause	**Recommended Corrective Action**
O_2 thermocouple or thermocouple circuit open	Check O_2 thermocouple and circuit wires for breaks or loose connections per Figure 8-3 and Figure 9-8. Repair breaks or loose connections or replace failed thermocouple. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.

COe TC Open ***(Combustibles sensor heater thermocouple open)***	
Probable Cause	**Recommended Corrective Action**
Combustibles sensor thermocouple open	Check thermocouple resistance (lead to ground) of reference and active thermocouples per Figure 8-3 and Figure 9-9. If either thermocouple is open or shorted to ground, replace combustibles sensor.

Table continued on next page

SB TC Open *(Sample block heater thermocouple open)*	
Probable Cause	**Recommended Corrective Action**
Sample block thermocouple or thermocouple circuit open	Check sample block thermocouple and circuit wires for breaks or loose connections per Figure 8-3 and Figure 9-8. Repair breaks or loose connections or replace failed thermocouple. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.

O2 TC Shorted *(Oxygen sensor heater thermocouple shorted)*	
Probable Cause	**Recommended Corrective Action**
O_2 thermocouple or thermocouple circuit shorted	Check O_2 thermocouple and circuit wires for short circuit condition per Figure 8-3 and Figure 9-8. Repair shorted wiring or replace failed thermocouple. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.
Slow heatup during cold start	Perform Reset procedure in Section 3, Configuration and Startup to continue operation. If alarm persists, refer to the O2 Htr Failure alarm procedure.

COe TC Shorted *(Combustibles sensor heater thermocouple shorted)*	
Probable Cause	**Recommended Corrective Action**
Combustibles sensor thermocouple shorted	Check thermocouple resistance (lead to ground) of reference and active thermocouples per Figure 8-3 and Figure 9-9. If either thermocouple is open or shorted to ground, replace combustibles sensor.
Slow heatup during cold start	Perform Reset procedure in Section 3, Configuration and Startup to continue operation. If alarm persists, refer to the COe Htr Failure alarm procedure.

SB TC Shorted *(Sample block heater thermocouple shorted)*	
Probable Cause	**Recommended Corrective Action**
Sample block thermocouple or thermocouple circuit shorted	Check sample block thermocouple and circuit wires for short circuit condition per Figure 8-3 and Figure 9-8. Repair shorted wiring or replace failed thermocouple. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.
Slow heatup during cold start	Perform Reset procedure in Section 3, Configuration and Startup to continue operation. If alarm persists, refer to the SB Htr Failure alarm procedure.

O2 TC Reversed *(Oxygen sensor heater thermocouple reversed)*	
Probable Cause	**Recommended Corrective Action**
O_2 thermocouple wires reversed	Check O_2 thermocouple wiring per Figure 8-3 and Figure 9-8. Check the wiring at the sensor and inside the electronics housing. Correct reversed-wires fault. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.

COe TC Reversed *(Combustibles sensor block heater thermocouple reversed)*	
Probable Cause	**Recommended Corrective Action**
Combustibles thermocouple wires reversed	Check combustibles thermocouple wiring per Figure 8-3 and Figure 9-9. Check the wiring at the sensor and inside the electronics housing. Correct reversed-wires fault. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.

SB TC Reversed *(Sample block heater thermocouple reversed)*	
Probable Cause	**Recommended Corrective Action**
Sample block thermocouple wires reversed	Check sample block thermocouple wiring per Figure 8-3 and Figure 9-8. Check the wiring at the sensor and inside the electronics housing. Correct reversed-wires fault. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.

Table continued on next page

ADC Failure *(Voltage to digital conversion could not complete)* **ADC Ref Error *(Voltage to digital conversion not accurate)***	
Probable Cause	**Recommended Corrective Action**
Incorrect wiring between electronics and sensor housings	Check all wiring between the electronics and sensor housings per Figure 8-3. Correct wiring faults.
Electronics package failure	Replace electronics package.

O2 Htr Failure *(Oxygen sensor heater could not reach final temperature)*	
Probable Cause	**Recommended Corrective Action**
O_2 heater circuit wiring open	Check O_2 cell heater circuit for broken wire or loose connection per Figure 8-3 and Figure 9-8. Repair broken wire or loose connection.
O_2 heater open	Check resistance of O_2 heater per Figure 9-8. Normal O_2 heater resistance is 62.5 Ohms. Replace O_2 heater if heater is open or has a large resistance.
Heater electronics failure	Check heater fuse F3 in electronics housing per Figure 8-1. If open, locate and correct cause of overload. If F3 is not open, or if cause of overload cannot be found, replace electronics package.

COe Htr Failure *(Combustibles sensor heater could not reach final temperature)*	
Probable Cause	**Recommended Corrective Action**
COe heater circuit wiring open	Check COe heater circuit for broken wire or loose connection per Figure 8-3 and Figure 9-9. Repair broken wire or loose connection.
COe heater open	Check resistance of COe heater per Figure 9-9. Normal COe heater resistance is 97.7 Ohms. Replace COe heater if heater is open or has a large resistance.
Heater electronics failure	Check heater fuse F3 in electronics housing per Figure 8-1. If open, locate and correct cause of overload. If F3 is not open, or if cause of overload cannot be found, replace electronics package.

SB Htr Failure *(Sample block heater could not reach final temperature)*	
Probable Cause	**Recommended Corrective Action**
Sample block heater circuit wiring open	Check sample block heater circuit for broken wire or loose connection per Figure 8-3 and Figure 9-8. Repair broken wire or loose connection.
Sample block heater open	Check resistance of sample block heater per Figure 9-8. Normal sample block heater resistance is 36.4 Ohms each (18.2 Ohms with both heaters in parallel). Replace sample block heater if heater is open or has a large resistance.
Heater electronics failure	Check heater fuse F4 in electronics housing per Figure 8-1. If open, locate and correct cause of overload. If F4 is not open, or if cause of overload cannot be found, replace electronics package.
Sensor housing exposed to high wind and/or extreme cold temperatures	If above probable causes are not causing the SB heater failure, install flange insulator (PN 6P00162H01).

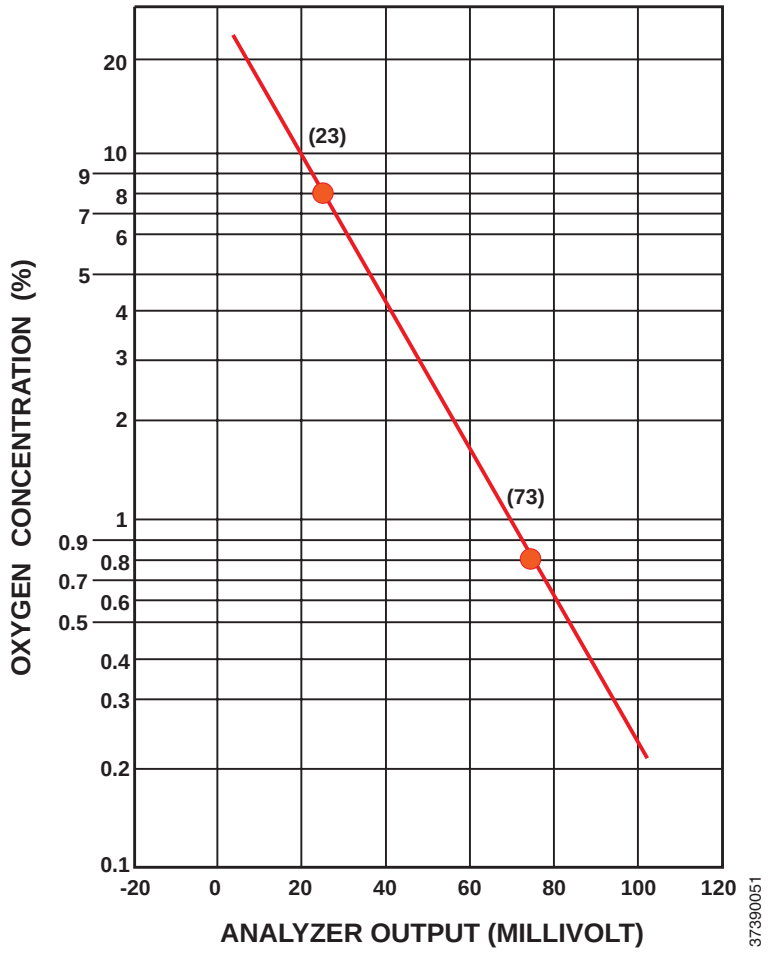
Cal Warning *(Calibration warning)* **Cal Failed *(Calibration failed)***	
Probable Cause	**Recommended Corrective Action**
Calibration gas supply low or gas connection leaking	Check calibration gas supplies and connections. Adjust gas pressure and flow. Replenish low calibration gas supplies and tighten or repair loose or leaking connections. When calibration gas supplies are adequate, recalibrate.
O_2 cell degraded or failed: O2 Slope Error (Slope <34.5 mV/Dec or >57.5 mV/Dec) O2 Constant Error (Constant not between -20 mV to +20 mV)	Check O_2 cell impedance by reading the O2 Cell Imped value via the LOI (see Figure 4-4, sheet 2), or the O2 Snsr R value via FOUNDATION fieldbus menu tree (see Figure 6-7, sheet 2). If cell impedance is zero, replace O_2 cell. If cell impedance is less than 5000 ohms, check for cell housing ground fault. Repair ground fault. If cell impedance is greater than 5000 ohms and no ground fault is indicated, replace O_2 cell. Flow calibration gas to the O_2 cell. Read the cell millivolt output. Plot the cell millivolt output and the calibration gas O_2 concentration on the chart shown in Figure 8-2. If the plotted values do not fall on the slope line shown in Figure 8-2, replace the O_2 cell.

Table continued on next page

Cal Warning *(Calibration warning)* **Cal Failed *(Calibration failed)***	
Probable Cause	**Recommended Corrective Action**
COe sensor degraded COe Slope Error (Slope not between 200 ppm/Ohm to 4,500 ppm/Ohm) COe Constant Error (Constant not between -100 Ohms to +100 Ohms)	Replace COe sensor or increase warning level (**SYSTEM**, **CALIB SETUP**, **COe Slope Warn** via HART.)
Low sample gas flow in sensor housing due to flow path plugging	Check the following portions of the flow path for plugging: • blowback filter • in-situ filter • eductor outlet path
Calibration Gas concentration incorrect or gas bottle empty	O_2 TOL Error (not within 10% of configured O2 test gas). COe TOL Error (not within 30% of configured CO test gas).

Table continued on next page

Figure 8-2. Oxygen and Cell Output



Board Temp Hi ***(Electronics temperature maximum exceeded, > 85ºC)***	
Probable Cause	**Recommended Corrective Action**
Electronics housing exposed to high ambient temperature	Insulate housing from source of high temperature and/or install cooling fan to remove heat from housing. Perform Reset procedure in Section 3, Configuration and Startup to continue operation.

EEPRM Chksm Fail ***(Non-volatile parameter storage corrupted)***	
Probable Cause	**Recommended Corrective Action**
Unit powered down during calibration parameter storage	Perform Reset procedure in Section 3, Configuration and Startup. Recalibrate the OCX and check/trim analog outputs.
Flash PROM failure	Replace electronics package.

O2 Temp Low ***(Oxygen sensor heater temperature low, < 710ºC)***	
Probable Cause	**Recommended Corrective Action**
Sensor housing exposed to high wind and/or extreme cold temperatures	Install sensor housing flange insulator (PN 6P00162H01).
High noise or voltage fluctuations in power supply	Check power supply for line noise or voltage fluctuations. Install filter power line kit (PN 6A00171G01) or high quality line filter for input power.

COe Temp Low ***(Combustion sensor heater temperature low, < 290ºC)***	
Probable Cause	**Recommended Corrective Action**
Sensor housing exposed to high wind and/or extreme cold temperatures	Install sensor housing flange insulator (PN 6P00162H01).
High noise or voltage fluctuations in power supply	Check power supply for line noise or voltage fluctuations. Install power line filter kit (PN 6A00171G01) or high quality line filter for input power.

SB Temp Low ***(Sample block heater temperature low, < 150ºC)***	
Probable Cause	**Recommended Corrective Action**
Sensor housing exposed to high wind and/or extreme cold temperatures	Install sensor housing flange insulator (PN 6P00162H01).
High noise or voltage fluctuations in power supply	Check power supply for line noise or voltage fluctuations. Install power line filter kit (PN 6A00171G01) or high quality line filter for input power.

Line Freq Error ***(AC power line frequency out of usable range, < 45 Hz or > 66 Hz)***	
Probable Cause	**Recommended Corrective Action**
High noise or voltage fluctuations in power supply	Check power supply for line noise or voltage fluctuations. Install power line filter kit (PN 6A00171G01) or high quality line filter for input power.
AC power line frequency is outside the usable range of the OCX universal power supply	Correct power supply frequency. AC power line frequency must be between 50 and 60 Hz.
Electronics package failure	Check power supply frequency with a calibrated oscilloscope or frequency meter and compare with line frequency. Replace electronics package if they do not agree within 1 Hz.

Line Voltage Low ***(AC power line voltage below minimum, < 85 VAC)***	
Probable Cause	**Recommended Corrective Action**
High noise or voltage fluctuations in power supply	Check power supply for line noise or voltage fluctuations. Install power line filter kit (PN 6A00171G01) or high quality line filter for input power.
Electronics package failure	Check power supply voltage and compare with line voltage. Replace electronics package if they do not agree within 5%.

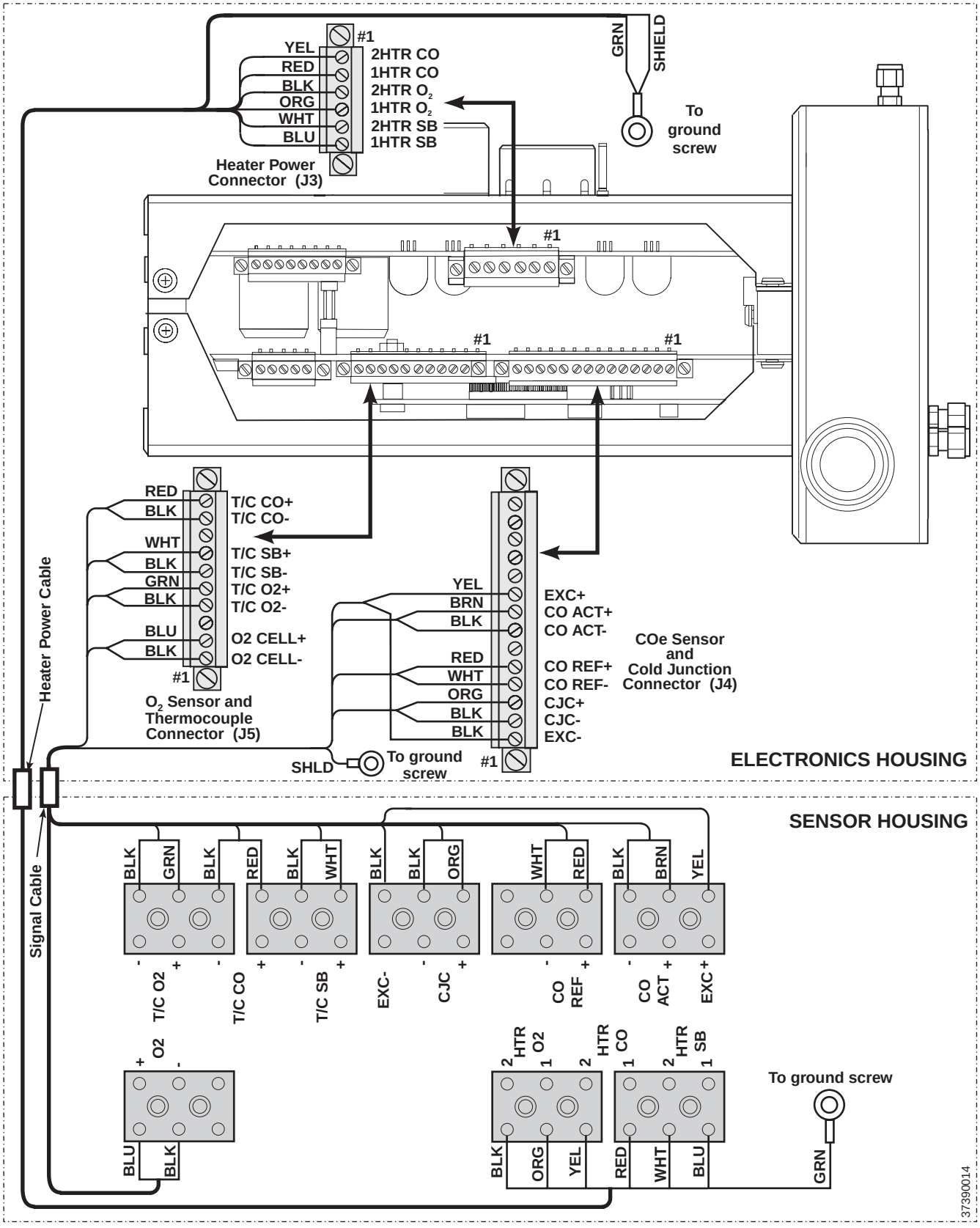
Table continued on next page

Line Voltage High ***(AC power line voltage above maximum, > 278 VAC)***	
Probable Cause	**Recommended Corrective Action**
High noise or voltage fluctuations in power supply	Check power supply for line noise or voltage fluctuations. Install power line filter kit (PN 6A00171G01) or high quality line filter for input power.
Electronics package failure	Check power supply voltage and compare with line voltage. Replace electronics package if they do not agree within 5%.

Htr Relay Failed ***(Heater relay failure)***	
Probable Cause	**Recommended Corrective Action**
High noise or voltage fluctuations in power supply	Check power supply for line noise or voltage fluctuations. Install power line filter kit (PN 6A00171G01) or high quality line filter for input power.
Electronics package failure	Replace electronics package.

Out Brd Failure ***(Output board failure)***	
Probable Cause	**Recommended Corrective Action**
Electronics package failure	Replace electronics package.

Figure 8-3. Electrical Connections Between Electronics and Sensor Housing



ALARM RELAY EVENTS

The Hazardous Area OCX 8800 contains an alarm relay that can be configured to activate on one of twelve different groups of events. These event groups, and the conditions that trigger them, are listed in Table 8-2, Alarm Relay Event Groups.

Table 8-2. Alarm Relay Event Groups

Alarm Relay Event	Alarms/Conditions
In Calibration	Calibration in progress
O_2 Temperature Error	Oxygen sensor heater temperature low *(O2 Temp Low)* Oxygen sensor heater temperature high *(O2 Temp Hi, O2 Temp Very Hi)* RTD excitation current error *(Ref Curr Err)*
Heater Failure	Oxygen sensor heater could not reach final temperature *(O2 HTR Failure)* Combustibles sensor heater could not reach final temperature *(COe Htr Failure)* Sample Block sensor heater could not reach final temperature *(SB Htr Failure)*
O_2 Sensor Error	Oxygen sensor resistance high *(O2 Sensor R High)* Oxygen sensor disconnected *(O2 Sensor Open)*
Calibration Failure	Calibration failed *(Cal Failed)*
Calibration Warning	Calibration warning *(Cal Warning)*
Board Temperature High	Electronics temperature maximum exceeded *(Board Temp Hi)*
Unit Failure	Any non-recoverable or heater relay off alarm *(O2 Temp Hi, O2 Temp Very Hi, COe Temp Hi, COE Temp Very Hi, SB Temp Hi, SB Temp Very Hi, O2 Htr Ramp Rate, COe Htr Rmp Rate, SB Htr Ramp Rate, O2 TC Shorted, O2 TC Reversed, COe TC Shorted, COe TC Reversed, SB TC Shorted, SB TC Reversed, ADC Failure, ADC Ref Error, Board Temp Hi, EEPRM Chksm Fail, Line Freq Error, Line Voltage Low, Line Voltage Hi, Htr Relay Failed, Out Brd Fail)*
Sample Block Temperature Error	Sample block heater temperature low *(SB Temp Low)* Sample block heater temperature high *(SB Temp Hi, SB Temp Very Hi)* RTD excitation current error *(Ref Curr Err)*
COe Sensor Temperature Error	Combustibles sensor heater temperature low *(COe Temp Low)* Combustibles sensor heater temperature high *(COe Temp Hi, COe Temp Very Hi)* RTD excitation current error *(Ref Curr Err)*
Power Input Error	AC power line frequency out of usable range *(Line Freq Err)* AC power line voltage below minimum *(Line Voltage Low)* AC power line voltage above maximum *(Line Voltage Hi)*
All Alarms	Any alarm

Section 9 Maintenance and Service

Overview . . . . . **page 9-1**
OCX 8800 Removal and Installation . . . . . **page 9-1**
Repair Sensor Housing . . . . . **page 9-10**
Repair Electronics Housing . . . . . **page 9-29**
Replace Tube Fittings . . . . . **page 9-35**

OVERVIEW

This section contains the procedures to maintain and service the Hazardous Area OCX 8800.

⚠WARNING

Install all protective equipment covers and safety ground leads after equipment repair or service. Failure to install covers and ground leads could result in serious injury or death.

⚠WARNING

It is recommended that the Hazardous Area OCX 8800 be removed from the stack for all service activities. The unit should be allowed to cool and be taken to a clean work area. Failure to comply may cause severe burns.

⚠WARNING

Disconnect and lock out power before working on any electrical components. There may be voltage up to 264 VAC.

OCX 8800 REMOVAL AND INSTALLATION

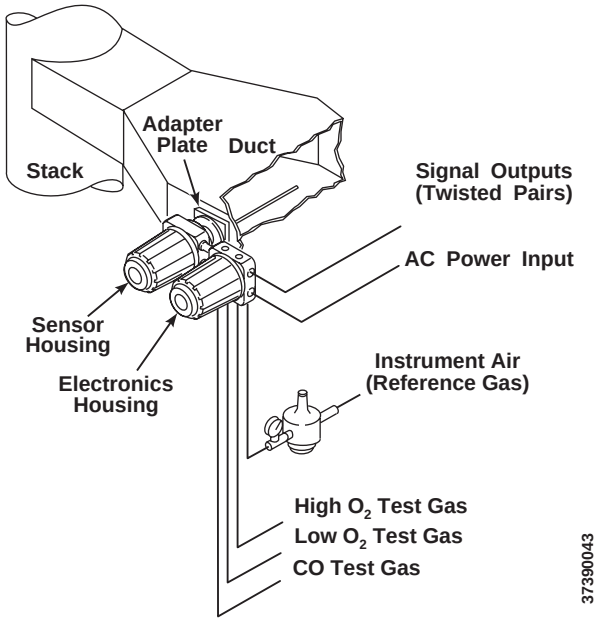
Use the following procedures to remove or install the Hazardous Area OCX 8800.

OCX with Integral Electronics

Remove Hazardous Area OCX 8800

1. Turn off power to the system.
2. Shut off the test gases at the cylinders and shut off the instrument air.
3. Disconnect the test gas and instrument air lines from the electronics housing, Figure 9-1.

Figure 9-1. OCX with Integral Electronics

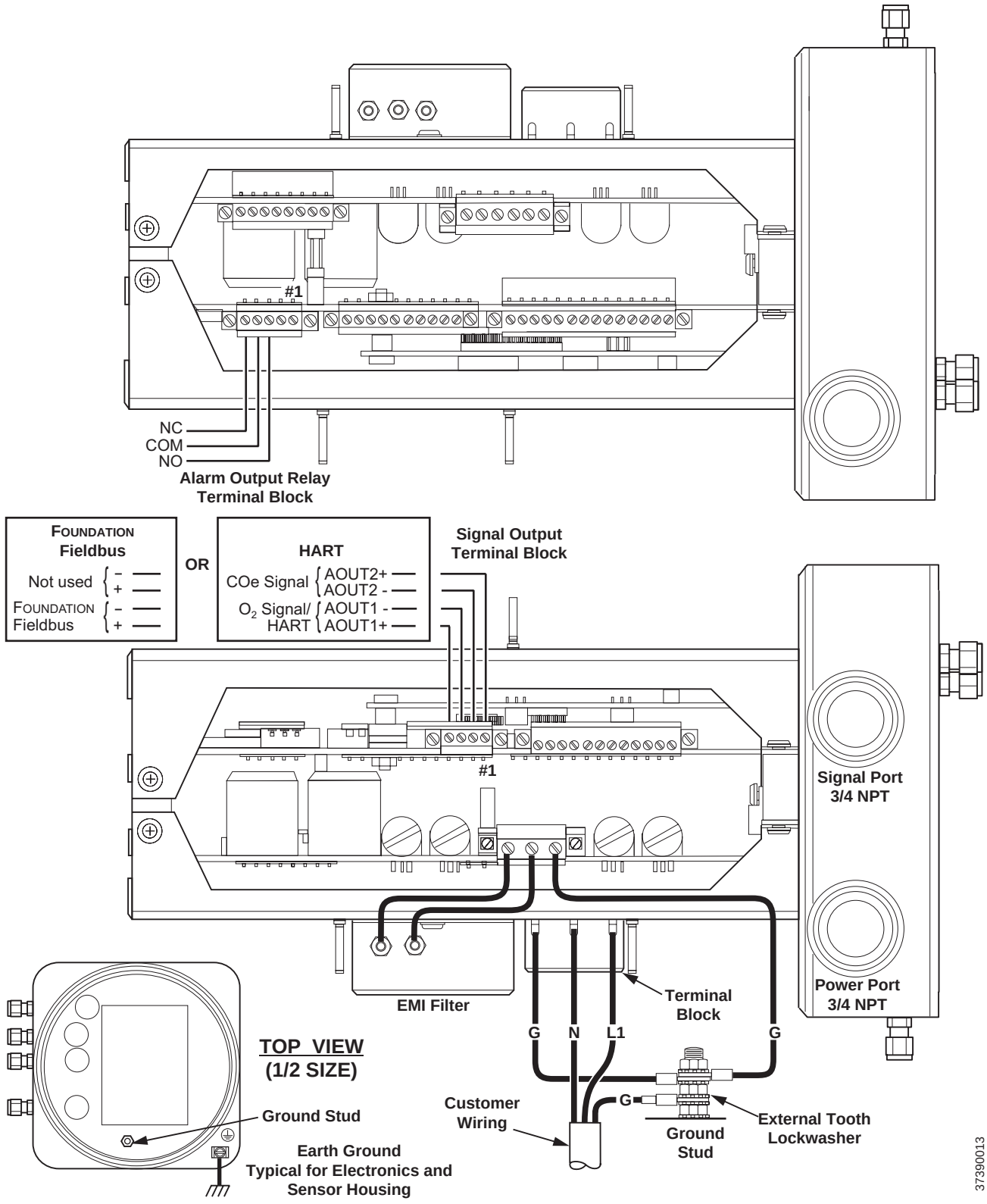


⚠WARNING

Explosion hazard! Before removing cover from sensor or electronics housing, allow at least 45 minutes to pass after power is disconnected. Failure to allow adequate time for all internal electrical charges to dissipate can result in serious injury or death..

4. Remove the cover from the electronics housing to expose the electronics housing terminal blocks, Figure 9-2.
5. Disconnect and remove the power leads from the AC power input terminal block and remove the ground lead from the ground stud.
6. Disconnect and remove the O_2 and COe signal leads from the 4-20 mA signal output terminal block.
7. If used, disconnect and remove the external relay leads from the alarm output relay terminal block.
8. Disconnect and remove customer power and signal wire conduits and wiring from the electronics housing.
9. Remove insulation to access the sensor housing mounting bolts. Unbolt the Hazardous Area OCX 8800 from the stack and take it to a clean work area.
10. Allow the unit to cool to a comfortable working temperature.

Figure 9-2. Electronics Housing Terminal Blocks



Install Hazardous Area OCX 8800

Observe the following cautions when installing the Hazardous Area OCX 8800 in a hot process stack. If the process is shut down and cooled, the transmitter can be installed in the stack prior to connecting the pneumatics and wiring.

⚠CAUTION

Whenever a positive stack pressure exists at the installation site, be sure to connect all pneumatic lines prior to installing the Hazardous Area OCX 8800 in the stack or ductwork. Failure to connect the pneumatic lines can allow the flow of contaminants into the Hazardous Area OCX 8800 ports.

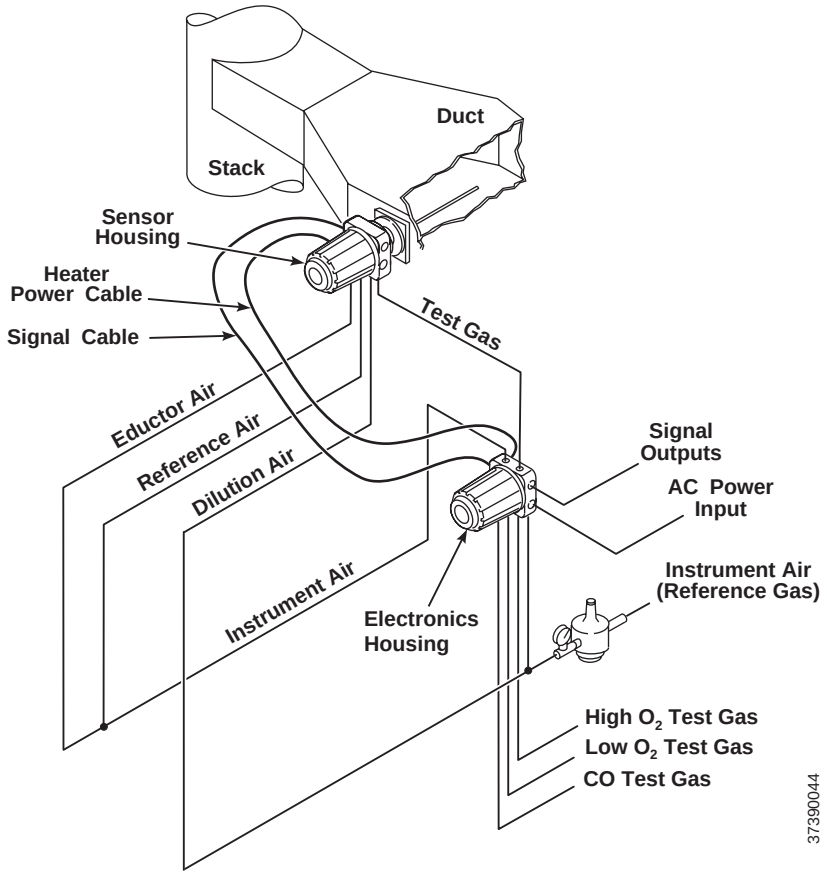
1. Bolt the Hazardous Area OCX 8800 to the stack and install insulation. Refer to Figure 9-1 and make sure all test gas lines and electrical connections are complete.
2. Connect the test gas lines and the instrument air lines to the electronics housing.
3. Remove the electronics housing cover.
4. Install customer power and signal conduits and wiring at the electronics housing.
5. If used, connect external relay leads to the alarm output relay terminal block, Figure 9-2.
6. Connect the O_2 and COe signal leads to the 4-20 mA signal output terminal block.
7. Connect the line (L1 wire) to the L1 terminal, and the neutral (N wire) to the N terminal on the AC power input terminal block.
8. Connect the ground lead to the ground stud. Secure the connection with two nuts. Attach a separate ground lead (G wire) from the ground stud to the G terminal on the power input terminal block.
9. Install the cover on the electronics housing.
10. Restore power to the system. Allow OCX to reach normal operating temperature.
11. Turn on the test gasses at the cylinders and open the instrument air supply valve.

OCX with Remote Electronics

Remove Sensor Housing

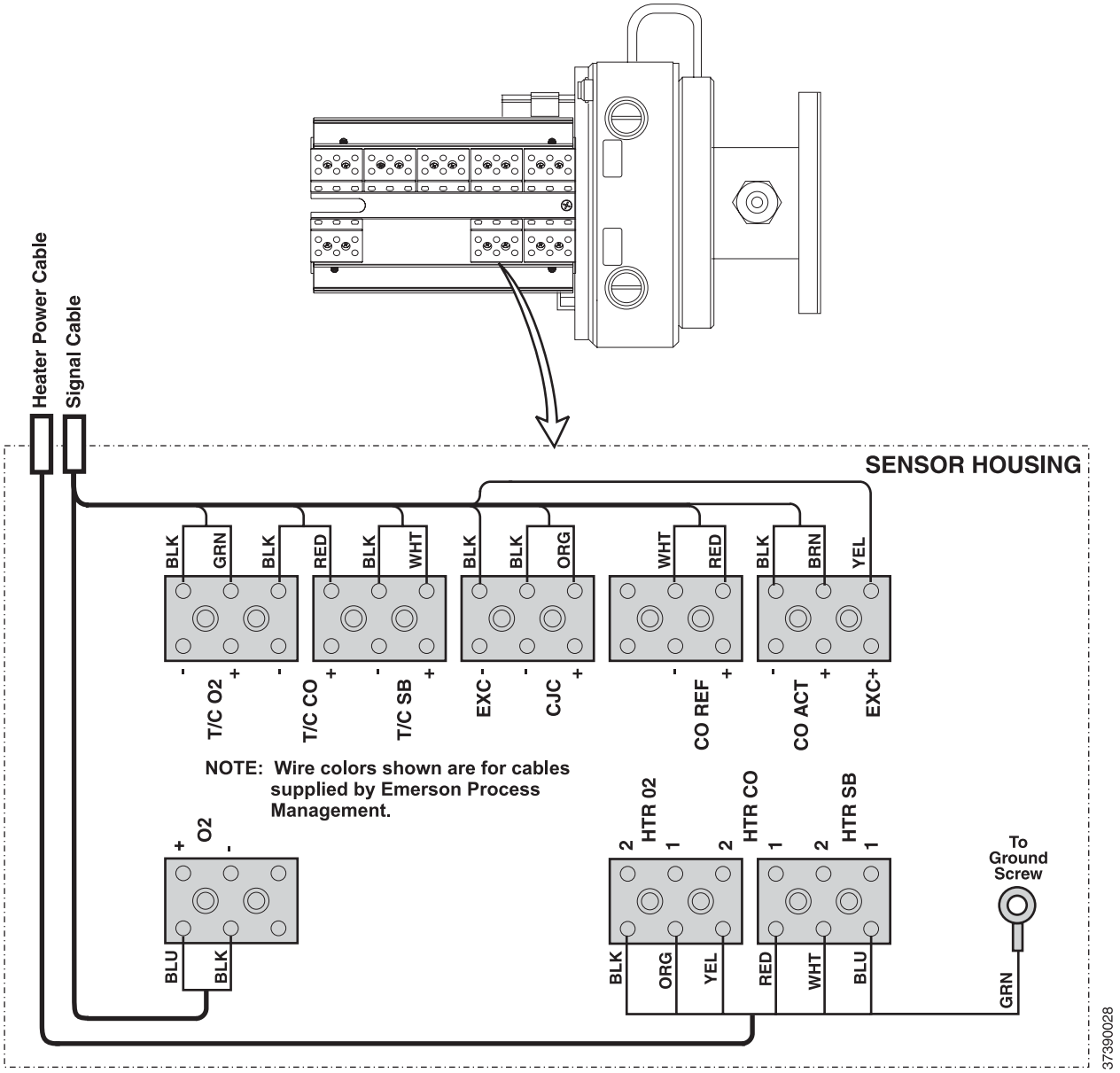
1. Turn off power to the system.
2. Shut off the test gasses at the cylinders and close the instrument air valve.
3. Disconnect the calibration gas, reference air, eductor air, and dilution air lines from the sensor housing, Figure 9-3.

Figure 9-3. OCX with Remote Electronics



4. Remove the cover from the sensor housing to expose the sensor housing terminal blocks, Figure 9-4.
5. Disconnect the signal cable from the O_2 and T/C terminal blocks, and from the CO and CJC terminal blocks.
6. Disconnect the heater power cable from the HTR terminal blocks.
7. If moving the sensor housing to another work site, disconnect and remove the power and signal cables from the sensor housing.
8. Remove insulation to access the mounting bolts. Unbolt the sensor housing from the stack and take it to a clean work area.
9. Allow the sensor housing to cool to a comfortable working temperature.

Figure 9-4. Sensor Housing Terminals



Install Sensor Housing

1. Insert and bolt the sensor housing in the stack and install insulation.
2. Connect the test gas, reference air, eductor air, and dilution air lines to the sensor housing.
3. Remove the sensor housing cover.
4. If removed, install the power and signal cables and the customer power and signal conduits and wiring at the sensor housing.
5. Connect the signal cable to O_2 and T/C terminal blocks and to the CO and CJC terminal blocks, Figure 9-4. Connect the heater power cable to the HTR terminal blocks.
6. Refer to Figure 9-3 and make sure all test gas lines and electrical connectors are complete.
7. Install the sensor housing cover.
8. Restore power to the system. Allow OCX to reach normal operating temperature.
9. Turn on the test gases at the cylinders and open the instrument air supply valve.

Remove Remote Electronics Housing

1. Turn off power to the system.
2. Shut off the test gases at the cylinders and close the instrument air supply valve, Figure 9-3.
3. Disconnect the test gas and instrument air lines from the remote electronics housing.
4. Remove the cover from the electronics housing to expose the electronics housing terminal blocks, Figure 9-5.
5. Disconnect and remove the power leads from the AC power input terminal block. Remove the ground lead from the ground stud.
6. Disconnect and remove the O_2 and COe signal leads from the 4-20 mA signal output terminal block.
7. If used, disconnect and remove the external relay leads from the alarm output relay terminal block.
8. Disconnect the signal cable leads from O_2 cell and thermocouple connector (J4), and from COe and CJC connector (J5), Figure 9-6.
9. Disconnect the heater cable leads from the heater power connector (J3).
10. If moving the electronics housing to another work site, disconnect and remove the power and signal cables and customer wiring conduits from the housing.
11. Remove the remote electronics housing from its mounting and move it to a suitable work area.

Figure 9-5. Electronics Housing Terminal Blocks

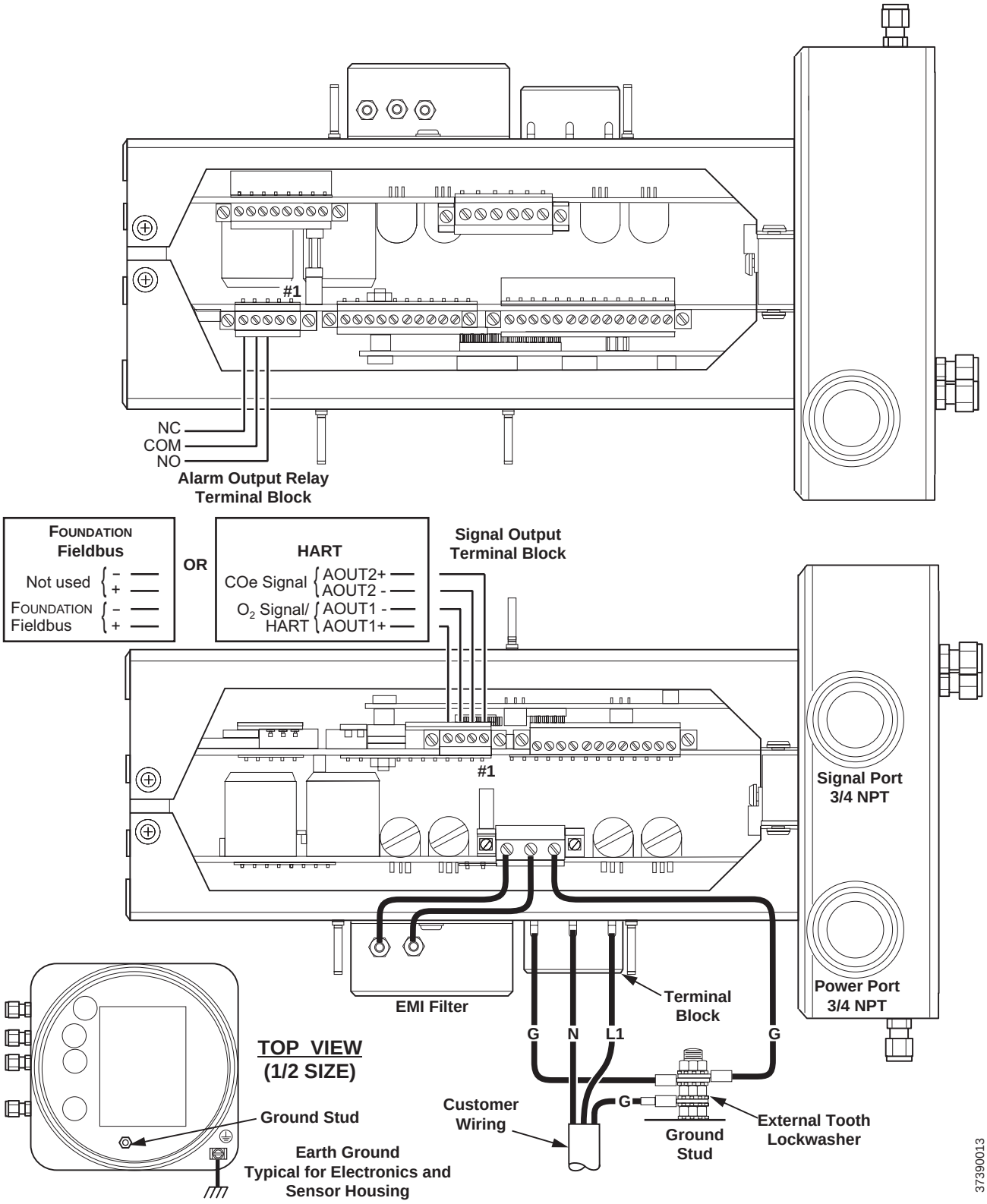
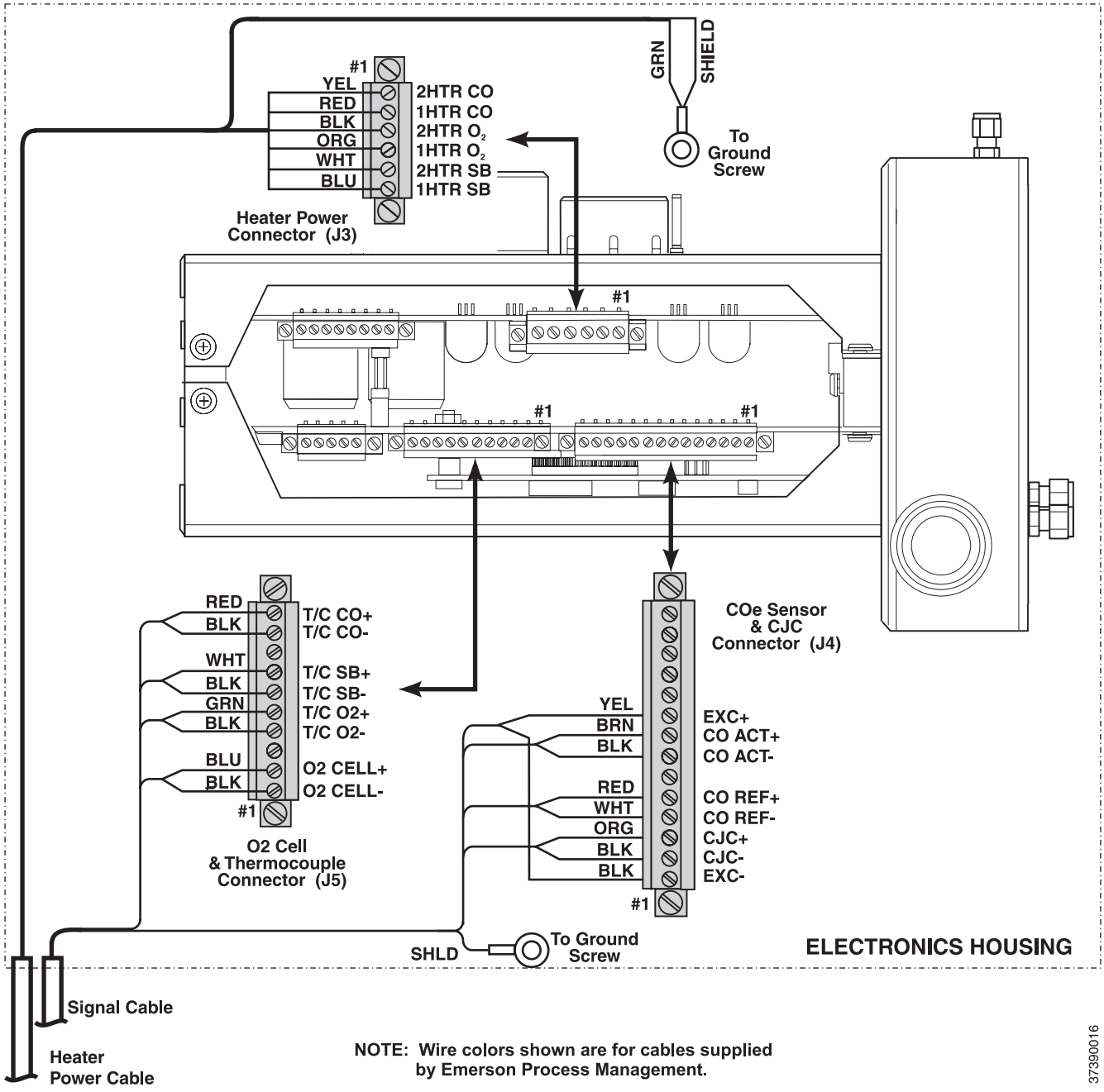


Figure 9-6. Remote Electronics Housing Cable Connections



Install Remote Electronics Housing

1. Mount remote electronics housing on wall or pipe within distance of signal and heater cables in use.
2. Remove the electronics housing cover.
3. If removed, install the power and signal cables and the customer power and signal conduits and wiring at the electronics housing.
4. Connect the signal cable leads to the O_2 cell and thermocouple connector (J4), and to the COe and CJC connector (J5), Figure 9-6.
5. Connect the heater cable leads to the heater power connector (J3).
6. Connect the line (L1 wire) to the L1 terminal, and the neutral (N wire) to the N terminal on the AC power input terminal block, Figure 9-6.
7. Connect the ground lead to the ground stud. Secure the connection with two nuts. Attach a separate ground lead (G wire) from the ground stud to the G terminal on the power input terminal block.
8. If used, connect external relay leads to the alarm output relay terminal.
9. Connect the test gas and instrument air lines to the remote electronics housing. Connect the calibration gas line and instrument air line to the remote electronics housing.
10. Refer to Figure 9-3 and Figure 9-6. Make sure all test gas lines and electrical connections are complete.
11. Install the cover on the electronics housing.
12. Turn on the test gasses at the cylinders and open the instrument air valve.
13. Restore power to the system.

REPAIR SENSOR HOUSING

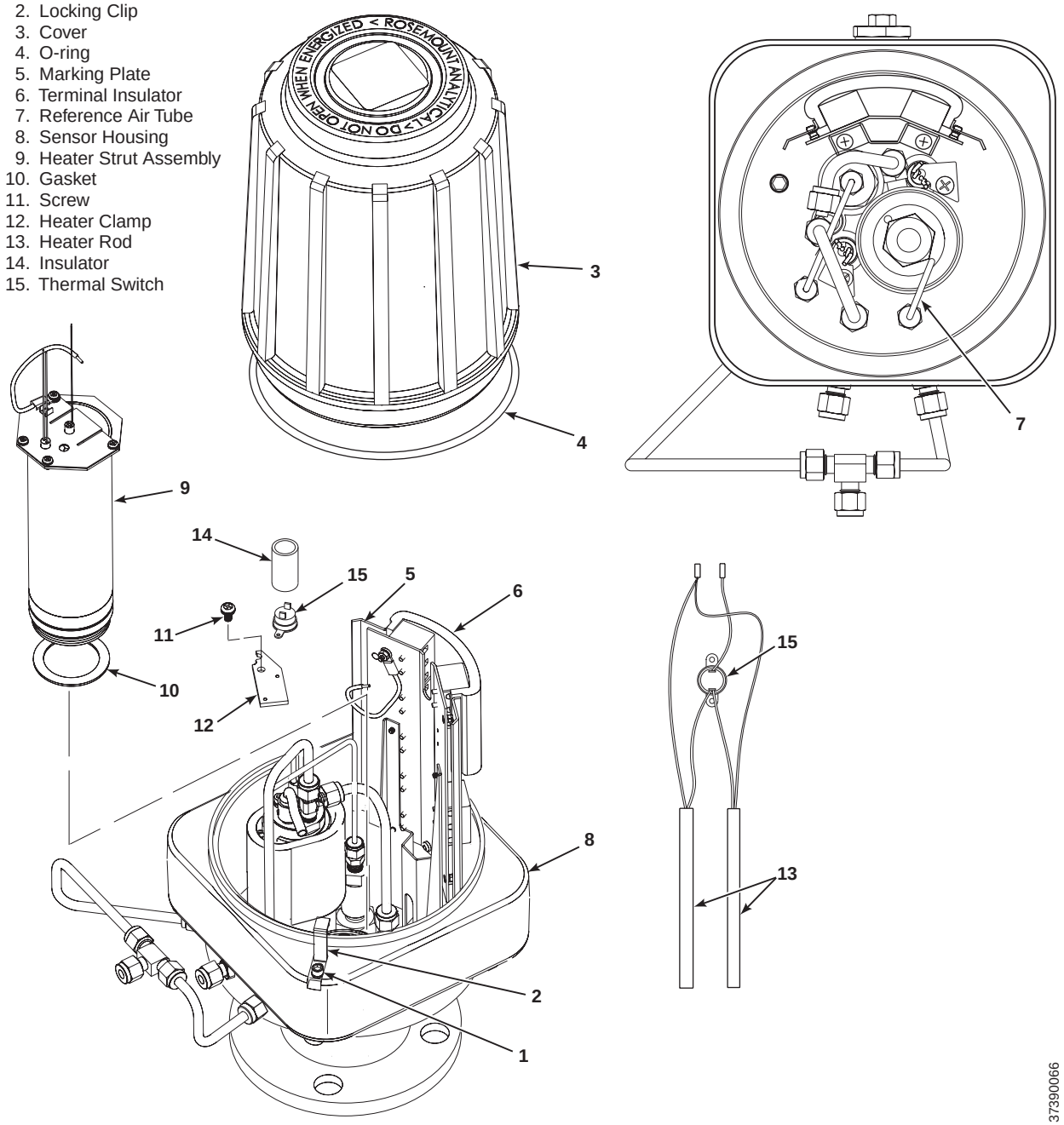
Use the following procedures to remove damaged components from the Hazardous Area OCX 8800 sensor housing and to install new replacement parts. Disassemble the unit only as needed to replace damaged components. Use the assembly procedures that apply to install replacement parts and reassemble the unit.

Sensor Housing Disassembly

Remove Cover and Terminals Insulator

1. Loosen screw (1, Figure 9-7) and slide locking clip (2) away from cover. Retighten screw (1).
2. With two hands or strap wrench, turn cover (3) counterclockwise to loosen. Unthread and remove cover.
3. Inspect cover o-ring (4) for wear or damage. Replace cover o-ring if damaged.
4. Unsnap terminal marking plates (5) and remove terminal insulator (6).

Figure 9-7. Removal of O_2 Cell and Heater Strut Assembly



Remove O_2 Cell and Heater Strut Assembly

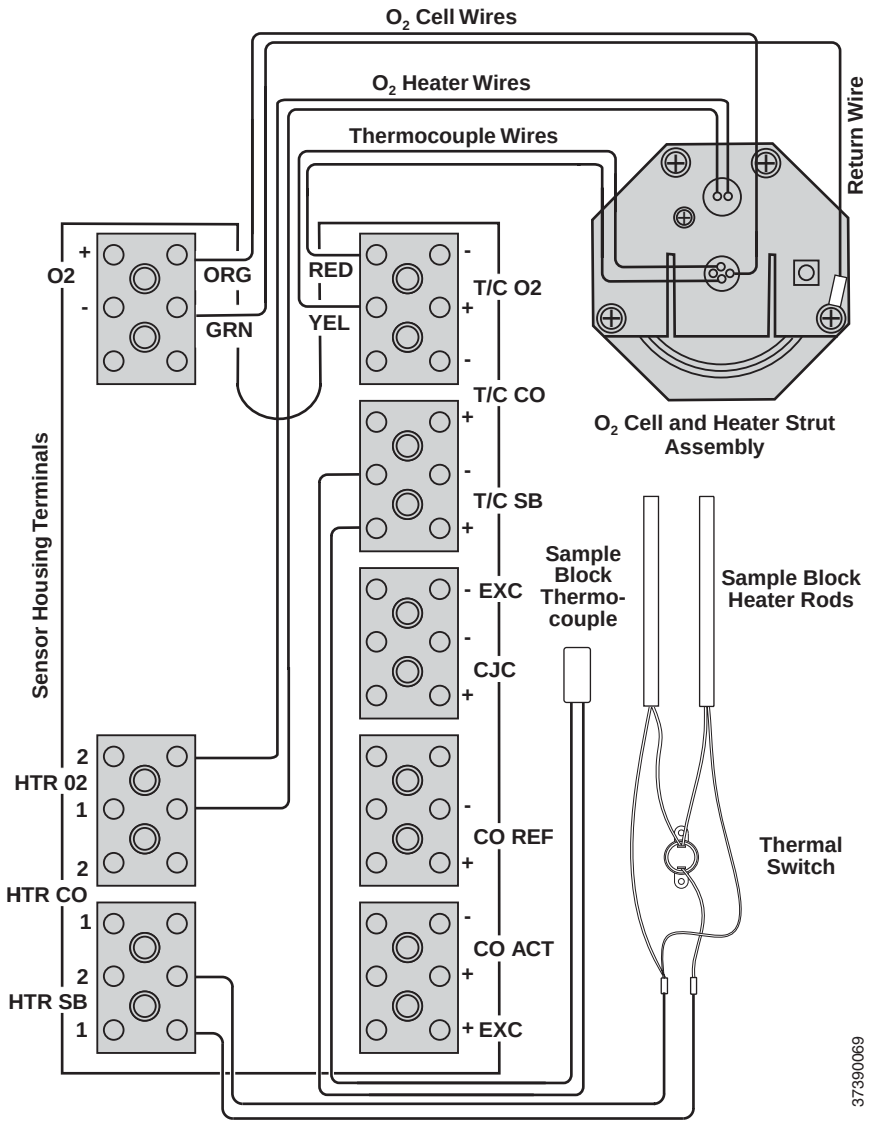
1. Remove reference air tube (7, Figure 9-7) from sensor housing (8).
2. See Figure 9-8. Disconnect and tag O_2 heater wires, O_2 cell and return wires, and thermocouple wires at the sensor housing terminals.
3. Remove the O_2 cell and heater strut assembly (9, Figure 9-7) from sensor housing (8). Remove and discard gasket (10).

Remove Sample Block Heater Rods

1. Disconnect sample block heater rod wires from terminal block. Refer to Figure 9-8.
2. Loosen screws (11, Figure 9-7) and rotate heater clamps (12) to release heater rods (13). One heater clamp secures each heater rod.
3. Slide sample block heater rods (13) out of housing (8).

NOTE
For easier access, you may remove two screws from base of terminal block mounting (13) and move terminal block assembly out of the way.

Figure 9-8. O_2 Cell, Thermocouple, and Heater Connections



Remove COe Sensor Assembly

1. Disconnect COe heater, thermocouple, and sensor wires from terminal blocks. Refer to Figure 9-9.
2. Remove insulator (1, Figure 9-10).

NOTE
For easier access, you may remove two screws from base of terminal block mounting (13) and move terminal block assembly out of the way.

3. Remove tubes (2, 3, and 4) from COe sensor assembly (5), eductor fittings (12 and 15), and sensor housing (7).
4. Unfasten bayonet connector of COe thermocouple (8) and remove thermocouple.
5. Loosen clamp screw of COe band heater (9) until heater rotates freely on sensor holder (11).

Figure 9-9. COe Sensor, Thermocouple, and Heater Connections

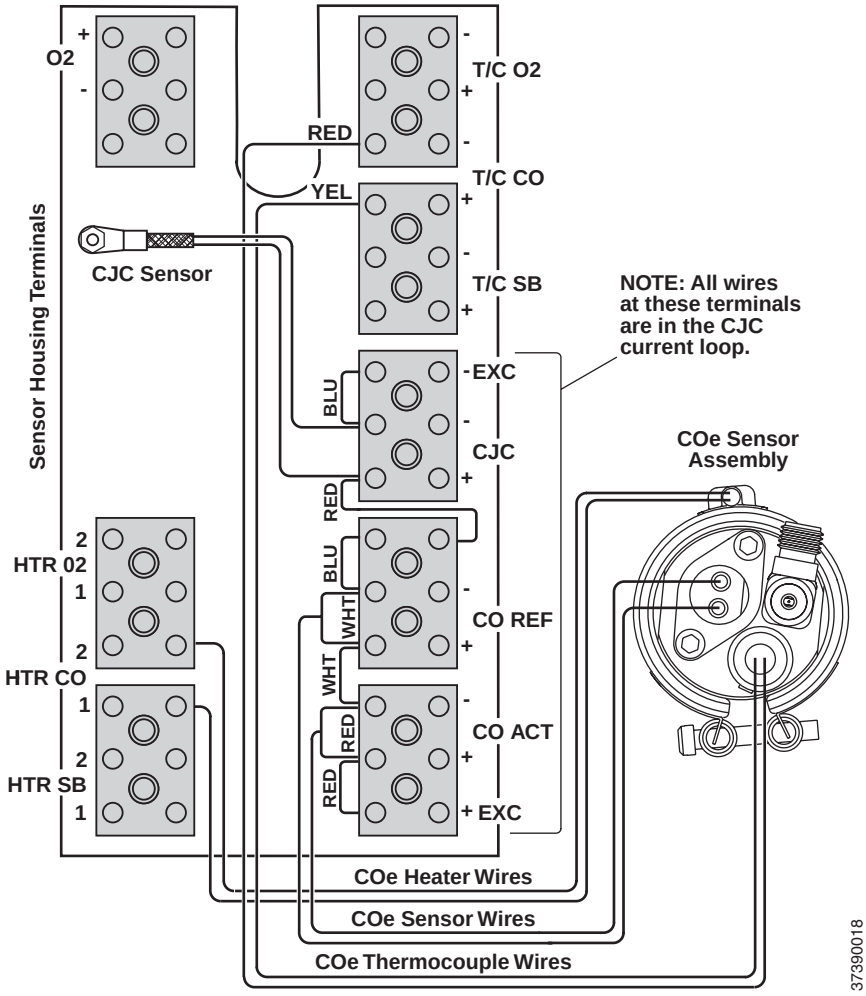
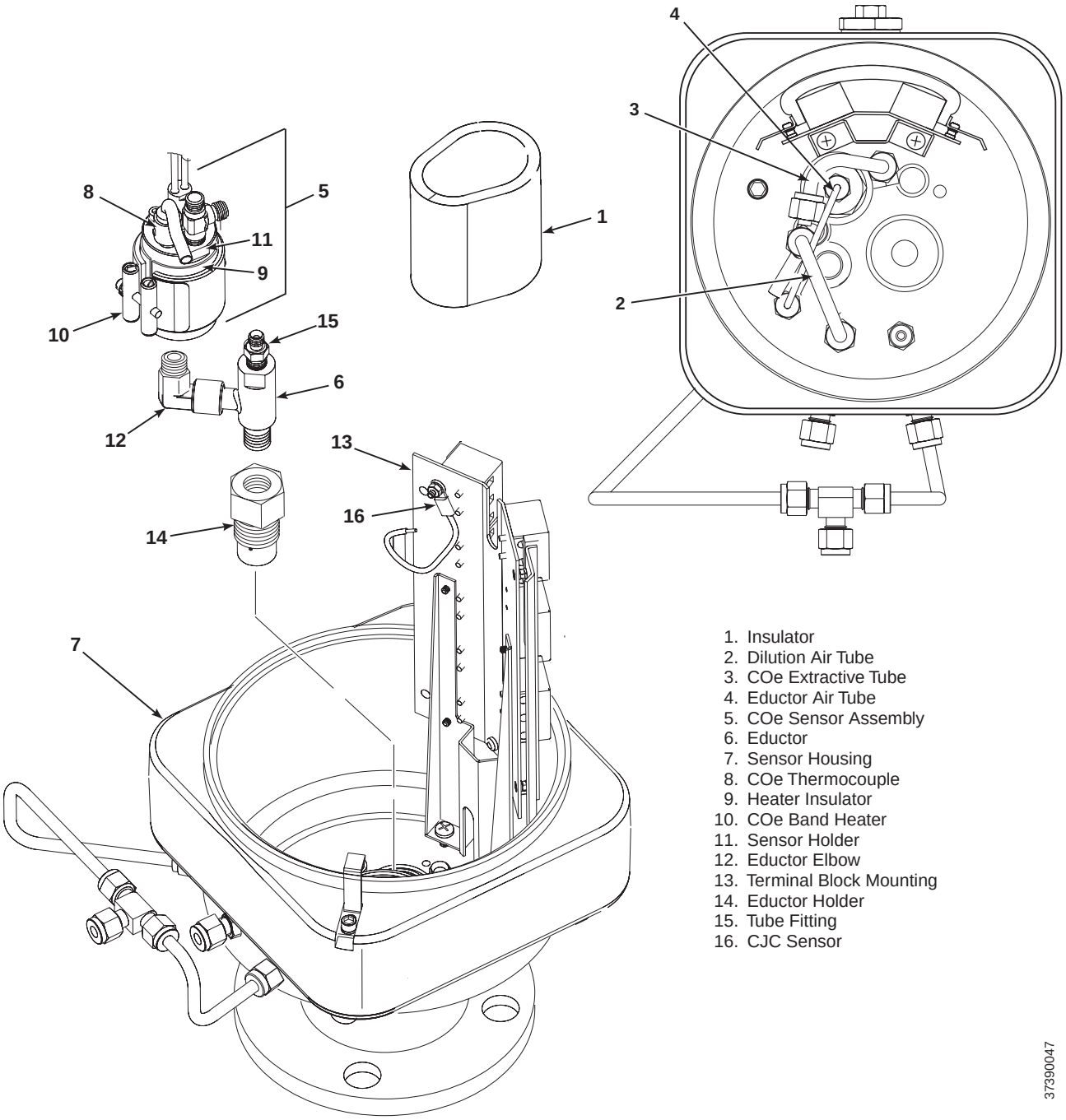


Figure 9-10. Removal of COe Sensor Assembly



1. Insulator
2. Dilution Air Tube
3. COe Extractive Tube
4. Eductor Air Tube
5. COe Sensor Assembly
6. Eductor
7. Sensor Housing
8. COe Thermocouple
9. Heater Insulator
10. COe Band Heater
11. Sensor Holder
12. Eductor Elbow
13. Terminal Block Mounting
14. Eductor Holder
15. Tube Fitting
16. CJC Sensor

6. See Figure 9-11. Using straightedge on the sensor holder flat, as shown, matchmark upper flange of sensor housing to show correct alignment of sensor holder.
7. With one wrench holding eductor elbow (12, Figure 9-10), and one wrench on flats of sensor holder (11), unthread and remove COe sensor assembly (5). Do not allow eductor elbow to turn.
8. Slide band heater (10) and heater insulator (9) from sensor holder (11).

Figure 9-11. Alignment of COe Sensor Assembly

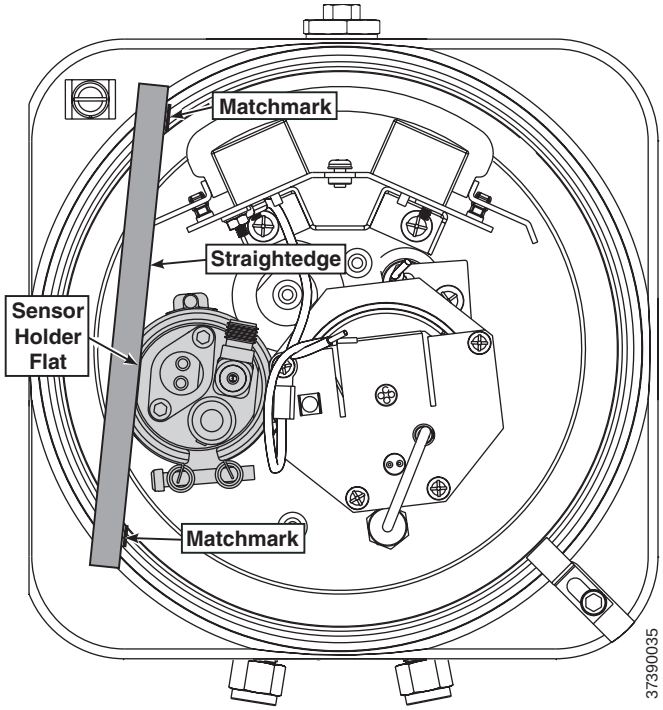
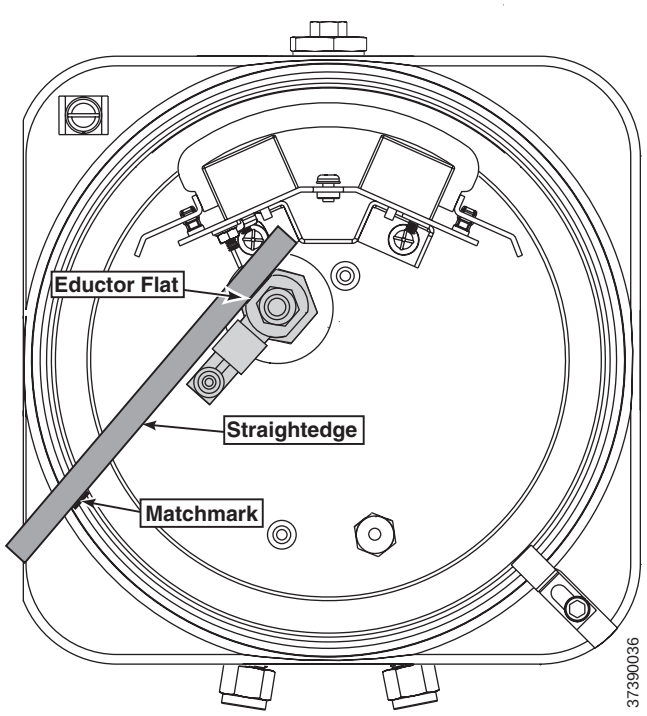


Figure 9-12. Eductor Alignment Matchmarks



Remove Eductor

The O_2 cell and heater strut assembly (9, Figure 9-7) and the COe sensor assembly (5, Figure 9-10) must be removed before you start this procedure.

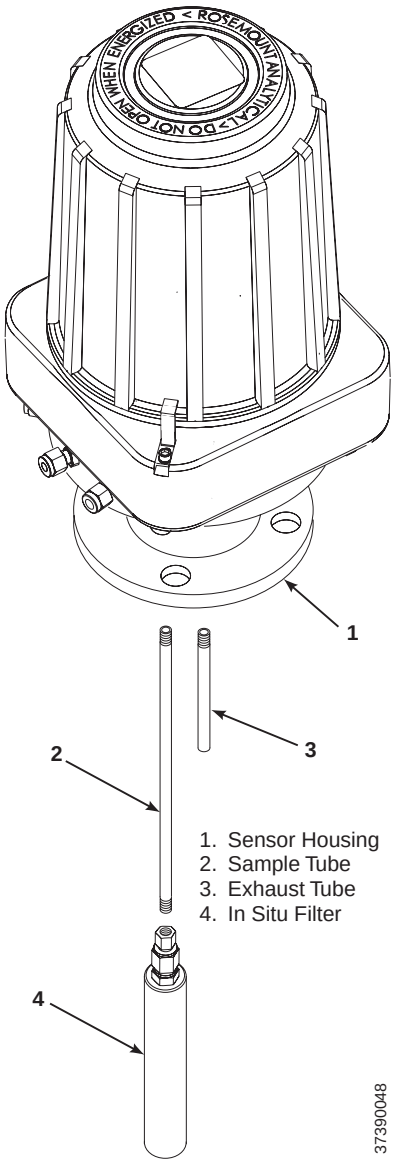
1. Use straightedge to matchmark alignment of eductor flat and elbow, as shown in Figure 9-12.
2. Unscrew terminal block mounting (13, Figure 9-10). Move terminal block mounting away from eductor (6).
3. Unscrew eductor holder (14) with eductor (6) and fittings (12 and 15) from sensor housing (7).
4. Clamp flats of eductor (6) in jaws of bench vise.

⚠WARNING

Use heat resistant gloves when removing mating parts from the eductor. The mating parts are bonded with a thread sealing compound. The compound softens at 450°F (232°C). The heated parts can cause severe burns.

5. Use a propane torch to heat the eductor (6) to 450°F (232°C), minimum. Apply the heat near the screw threads.
6. While heating the eductor (6), use wrench to apply removal torque to elbow (12), eductor holder (14), or tube fitting (15) until the thread sealant softens. Remove mating parts (12, 14, and 15).
7. Use MEK or methylene chloride solvent to clean thread sealant residue from the pipe threads of the mating parts. Refer to applicable MSDS sheet for solvent handling precautions.

Figure 9-13. Removal of Sample and Exhaust Tubes



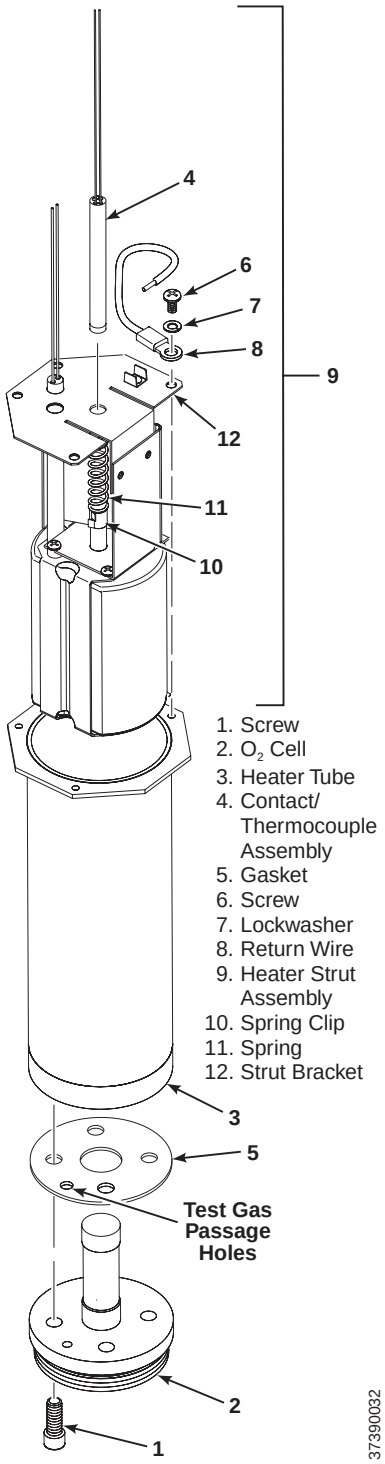
Remove Sample and Exhaust Tubes

⚠WARNING

Use heat resistant gloves when removing the probe tube or exhaust tube. The tubes are bonded with a thread sealing compound. The compound softens at 450°F (232°C). The heated parts can cause severe burns.

1. Secure the sensor housing (1, Figure 9-13) in soft (plastic, wood, or brass) vice jaws.
2. Use a propane torch to heat the sample tube (2) or exhaust tube (3) to 450°F (232°C), minimum. Apply the heat near the threaded end of the tube.
3. While heating the tube, use a pipe wrench to apply removal torque to part being removed. Apply torque until the pipe thread sealant softens. Remove and discard the used sample tube (2), exhaust tube (3), or in-situ filter (4).
4. Use MEK or methylene chloride solvent to clean thread sealant residue from the internal pipe threads in the housing. Refer to applicable MSDS sheet for solvent handling precautions.

Figure 9-14. O_2 Cell, Heater, and Thermocouple, Exploded View



1. Screw
2. O_2 Cell
3. Heater Tube
4. Contact/ Thermocouple Assembly
5. Gasket
6. Screw
7. Lockwasher
8. Return Wire
9. Heater Strut Assembly
10. Spring Clip
11. Spring
12. Strut Bracket

⚠CAUTION

Do not remove the O_2 cell unless you are certain it needs to be replaced. Removal may damage the cell and platinum pad. Remove the O_2 cell for cell replacement only.

Disassemble O_2 Cell and Heater Strut Assembly

Do not attempt to replace the O_2 cell until all other possibilities for poor performance have been considered. If cell replacement is needed, order the O_2 cell replacement kit (Refer to Section 10, Replacement Parts).

The O_2 cell replacement kit contains an O_2 cell and flange assembly, gaskets, socket head cap screws, and anti-seize compound. The items are carefully packaged to preserve precise surface finishes.

Do not remove items from the package until they are ready to be used.

1. Remove the four allen cap screws (1, Figure 9-14) from the O_2 cell (2). Remove the O_2 cell. The cell flange has a notch that may be used to gently pry the flange away from heater tube (3).

NOTE
The pad on the end of contact/thermocouple assembly (4) will sometimes fuse to the O_2 cell (2).

2. If the O_2 cell is fused to the contact pad, push the O_2 cell back into the heater tube (against spring pressure) and quickly twist the O_2 cell. The cell and contact pad should separate. If the contact pad stays fused to the cell, a new contact/thermocouple assembly (4) must be installed.
3. Remove and discard gasket (5). Clean the mating surface of heater tube (3). Remove burrs and raised surfaces with a block of wood and crocus cloth.

⚠CAUTION

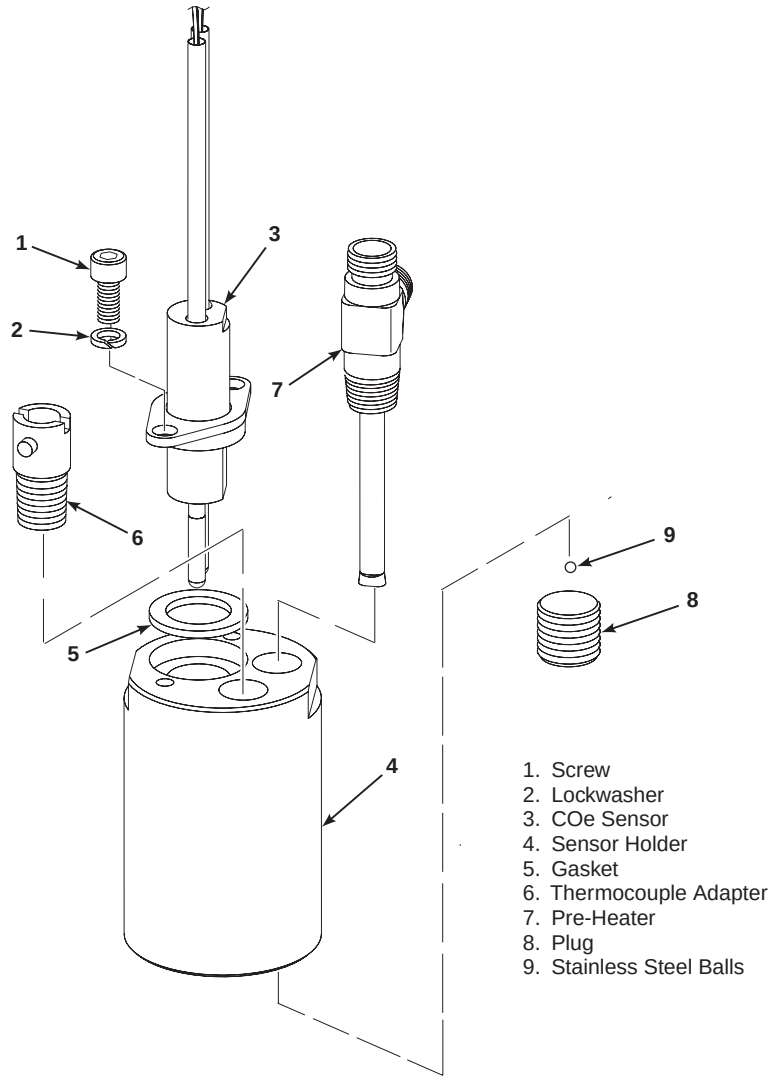
Use care when handling contact and thermocouple assembly. The ceramic rod in this assembly is fragile.

4. Remove screws (6), lockwashers (7), return wire (8), and heater strut assembly (9).
5. If replacing contact and thermocouple assembly (4), use a pencil to mark location of spring clip (10) before removing. Squeeze tabs on spring clip to remove. Retain spring clip and spring (11); replace if damaged.
6. While carefully handling new contact and thermocouple assembly (4) lay old assembly next to new one. Transfer match marks to new assembly.
7. Carefully guide new contact and thermocouple assembly (4) through strut bracket (12), spring (11), and spring clip (10) until spring clip reaches pencil mark.

Disassemble COe Sensor Assembly

1. Carefully remove screws (1, Figure 9-15), lockwashers (2), and COe sensor (3) from sensor holder (4). Remove and discard gasket (5).
2. If damaged, use the following procedure to remove thermocouple adaptor (6) from sensor holder (4):
   a. Use a propane torch to heat the thermocouple adaptor to 450°F (232°C), minimum.
   b. While heating, use a flat-head screwdriver to apply removal torque. Apply torque until the pipe thread sealant softens. Remove and discard the thermocouple adaptor.
   c. Use MEK or methylene chloride solvent to clean thread sealant residue from the internal pipe threads in the sensor holder. Refer to applicable MSDS sheet for solvent handling precautions.

Figure 9-15. COe Sensor, Exploded View



⚠CAUTION

Always remove the stainless steel balls (approximately 200) from sensor holder before removing or installing pre-heater. Turning pre-heater in the sensor holder with the stainless steel balls in place will cause permanent damage to the pre-heater.

3. If pre-heater (7) is to be removed, clamp flats of sensor holder (4) in vise jaws with plug (8) pointing up. Remove plug. Unclamp sensor holder and pour stainless steel balls (9) into a container.

NOTE
Pre-heater should only be removed when pre-heater or sensor holder is damaged. If removal is not required, leave the pre-heater installed in the sensor holder.

4. Unthread and remove pre-heater (7).
5. Use a cleaning solvent to thoroughly clean stainless steel balls (9) and pre-heater chamber in sensor housing (4). Refer to applicable MSDS sheet for solvent handling precautions.

Sensor Housing Assembly

Assemble COe Sensor Assembly

⚠CAUTION

Always remove the stainless steel balls (approximately 200) from sensor holder before removing or installing pre-heater. Turning pre-heater in the sensor holder with the stainless steel balls in place will cause permanent damage to the pre-heater.

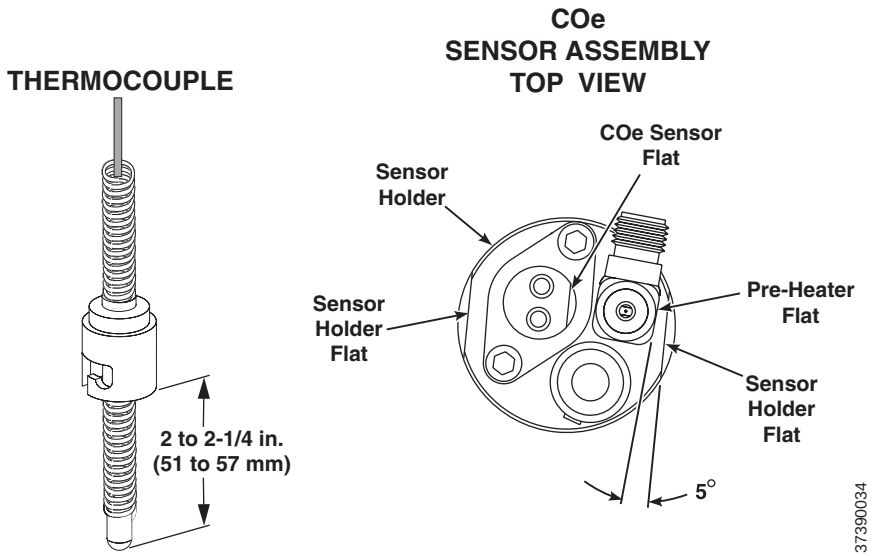
1. If pre-heater (7, Figure 9-15) was removed, apply pipe thread sealant (Loctite #567) to the external pipe threads of pre-heater (7) and plug (8). Do not apply sealant to the first turn of the pipe threads.
2. Clamp flats of sensor holder (4) in vise jaws with pre-heater port pointing up.
3. Install and tighten pre-heater (7). Align pre-heater to flat of sensor holder (4) as shown in Figure 9-16.
4. Invert sensor holder (4, Figure 9-15) in vise and pour stainless steel balls (9) into plug port. Press down on stainless steel balls and tap sensor holder with plastic hammer to compact balls in pre-heater chamber.
5. Install and tighten plug (8).

⚠CAUTION

Use care when installing the combustibles (COe) sensor. The RTD elements are fragile and correct alignment in sensor holder is required for proper OCX operation.

6. Lubricate and install COe sensor gasket (5). Apply anti-seize compound to threads of screws (1).

Figure 9-16. COe Sensor and Pre-Heater Alignment



7. Install COe sensor (3), lockwashers (2), and screws (1). Rotate flat of COe sensor (3) to center of sensor holder (4).
8. Align COe sensor flat parallel to sensor holder flat, as shown in Figure 9-16. Tighten screws (1, Figure 9-15).
9. If replacing thermocouple adaptor (6), apply anti-seize to the pipe threads. Install and tighten thermocouple adaptor.

Assemble O_2 Sensor and Heater Strut Assembly

1. See Figure 9-14. Assemble O_2 cell (2), gasket (5), and heater tube (3). Make sure the test gas passage holes line up with each other in all components.
2. Apply a small amount of anti-seize compound to the screw threads and use screws (1) to secure assembly. Torque to 35 in-lbs (4 N·m).
3. Carefully slide O_2 heater strut assembly (9) into heater tube (3).
4. Press down on the back plate of strut bracket (12) to ensure spring (11) tension is present to hold contact pad against O_2 cell (2).
5. Secure strut bracket (12) and return wire (8) with four screws (6) and lockwashers (7). Make sure return wire (8) is tightly fastened. This is the ground side connection for the O_2 cell.

Install Sample and Exhaust Tubes

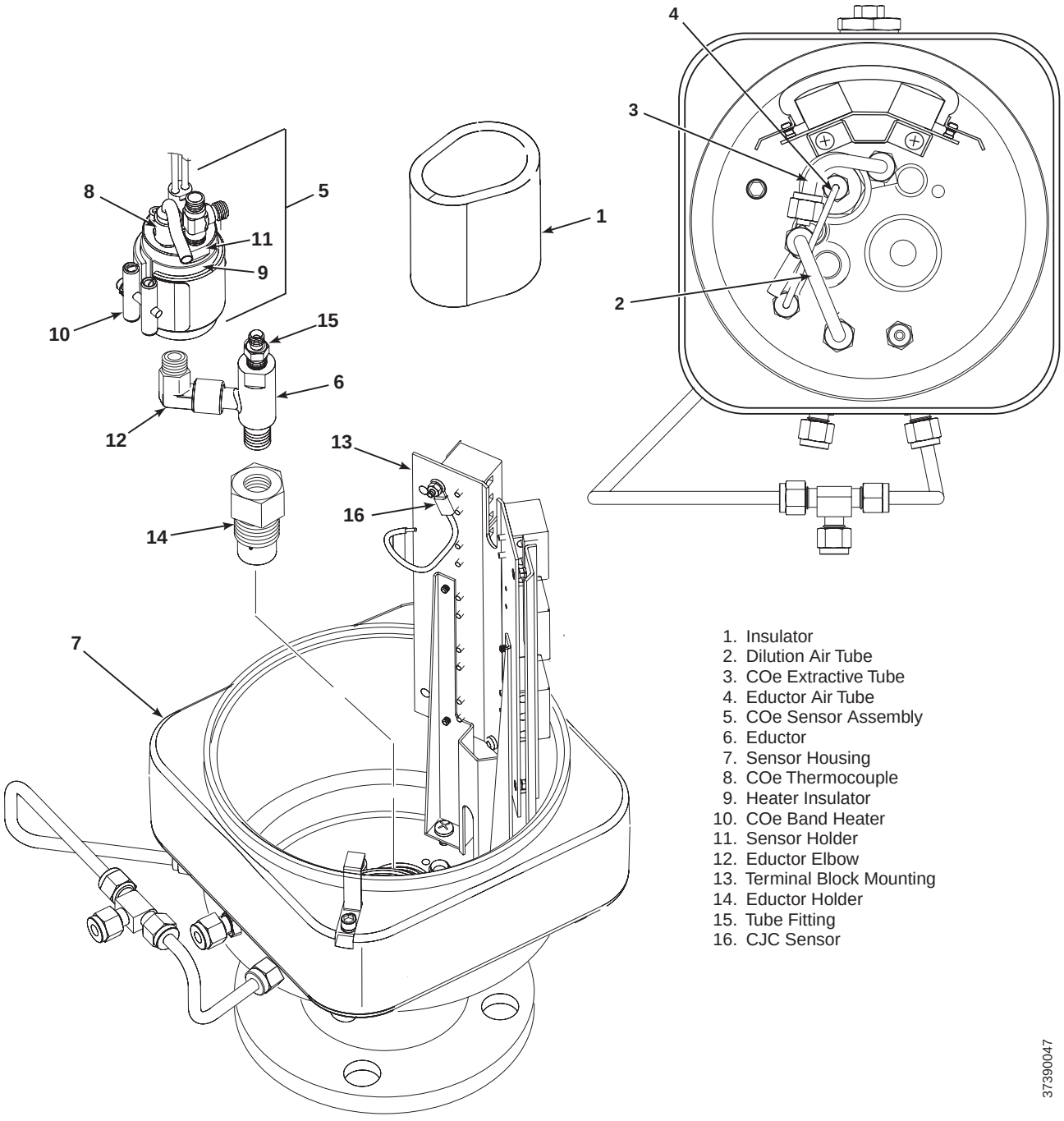
1. See Figure 9-13. Apply pipe thread sealant (Loctite #567) to the replacement sample tube (2) or exhaust tube (3) pipe threads. Do not apply sealant to the first turn of the pipe threads.
2. Thread the sample tube (2) or exhaust tube (3) into the housing (1). Use a pipe wrench to tighten the tube.
3. If used, install and tighten insitu filter (4).

Install Eductor

If installed, the O_2 cell and heater strut assembly (9, Figure 9-7) must be removed from sensor housing (8), before you install the eductor.

1. Apply pipe thread sealant (Loctite #567) to the external pipe threads of eductor (6, Figure 9-17). Do not apply sealant to the first turn of the pipe threads.

Figure 9-17. Installation of Eductor and COe Sensor



1. Insulator
2. Dilution Air Tube
3. COe Extractive Tube
4. Eductor Air Tube
5. COe Sensor Assembly
6. Eductor
7. Sensor Housing
8. COe Thermocouple
9. Heater Insulator
10. COe Band Heater
11. Sensor Holder
12. Eductor Elbow
13. Terminal Block Mounting
14. Eductor Holder
15. Tube Fitting
16. CJC Sensor

2. Install and tighten eductor (6) in eductor holder (14).
3. Install and tighten elbow (12) on eductor (6). Male port of elbow must point up and be in line with long axis of eductor.
4. Apply anti-seize compound to the external pipe threads of eductor holder (14).
5. Install and tighten eductor holder (14) in sensor housing (7). Align eductor with matchmarks, as shown in Figure 9-18.

Figure 9-18. Eductor Alignment Matchmarks

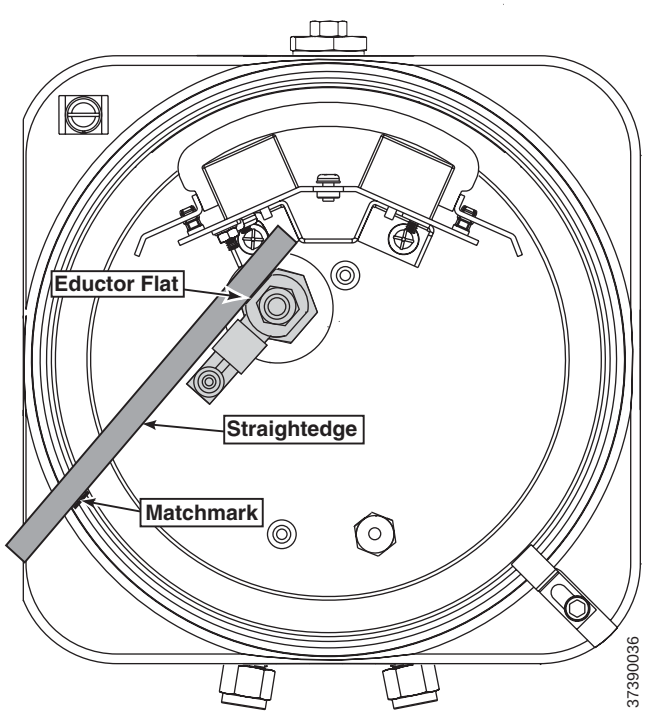
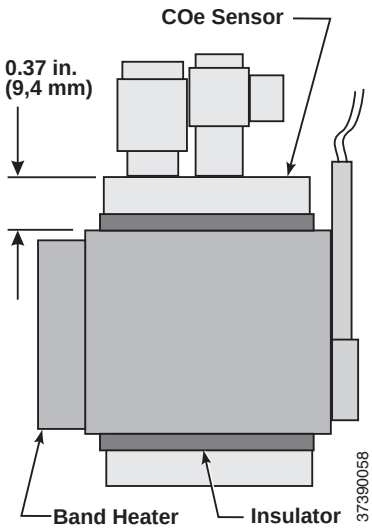


Figure 9-19. Band Heater Height



Install COe Sensor Assembly

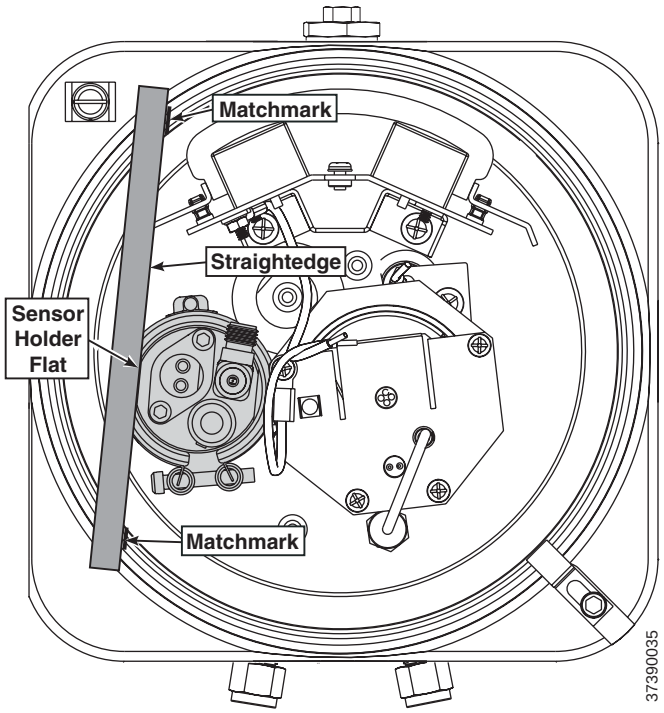
1. Apply pipe thread sealant (Loctite #567) to the exposed pipe threads of eductor elbow (12, Figure 9-17). Do not apply sealant to the first turn of the pipe threads.
2. Screw sensor holder (11) onto eductor elbow (12).
3. With wrenches on eductor elbow (12) and on flats of sensor holder (11), tighten sensor holder. Do not allow eductor elbow to turn.
4. Tighten sensor holder (11) to align outside flat with matchmark on sensor housing flange, as shown in Figure 9-20.

⚠CAUTION

The heater insulator prevents current leakage between the band heater and the sensor holder. Failure to properly install the insulator may cause the device to trip a ground fault interrupt circuit.

5. Wrap heater insulator (9) around sensor holder (11). Make sure the insulator joint lines up with the band gap of the COe band heater (10).
6. Slide COe band heater (10, Figure 9-17) up onto sensor holder (11). Do not tighten the band heater at this time. Heater must rotate freely around sensor holder.
7. Check for proper height of COe heater thermocouple (Figure 9-16). Thread bayonet connector up or down to adjust height.

Figure 9-20. COe Sensor Holder Alignment



8. Install and fasten thermocouple (8, Figure 9-17).
9. Position band heater as shown in Figure 9-19 and Figure 9-20 and tighten band heater clamp screw. The heater insulator (9) end joint must line up with the band gap of the COe band heater (10).
10. Reconnect the COe sensor, thermocouple, and heater wires at the sensor housing terminal blocks. Refer to Figure 9-21.
11. Install and fasten the COe insulator (1, Figure 9-17) around COe sensor assembly (5). All wiring must remain outside of the insulator.
12. If terminal block mounting (13, Figure 9-17) was moved, reinstall with two base mounting screws.

Figure 9-21. COe Sensor, Thermocouple, and Heater Connections

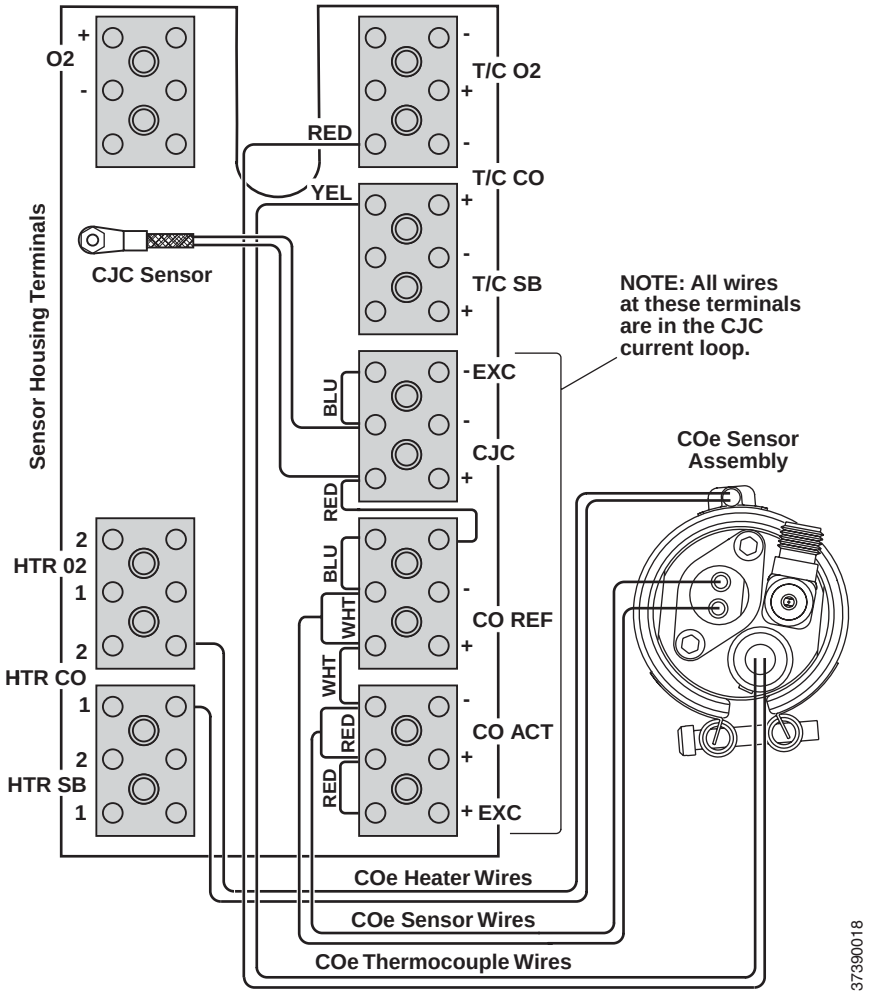
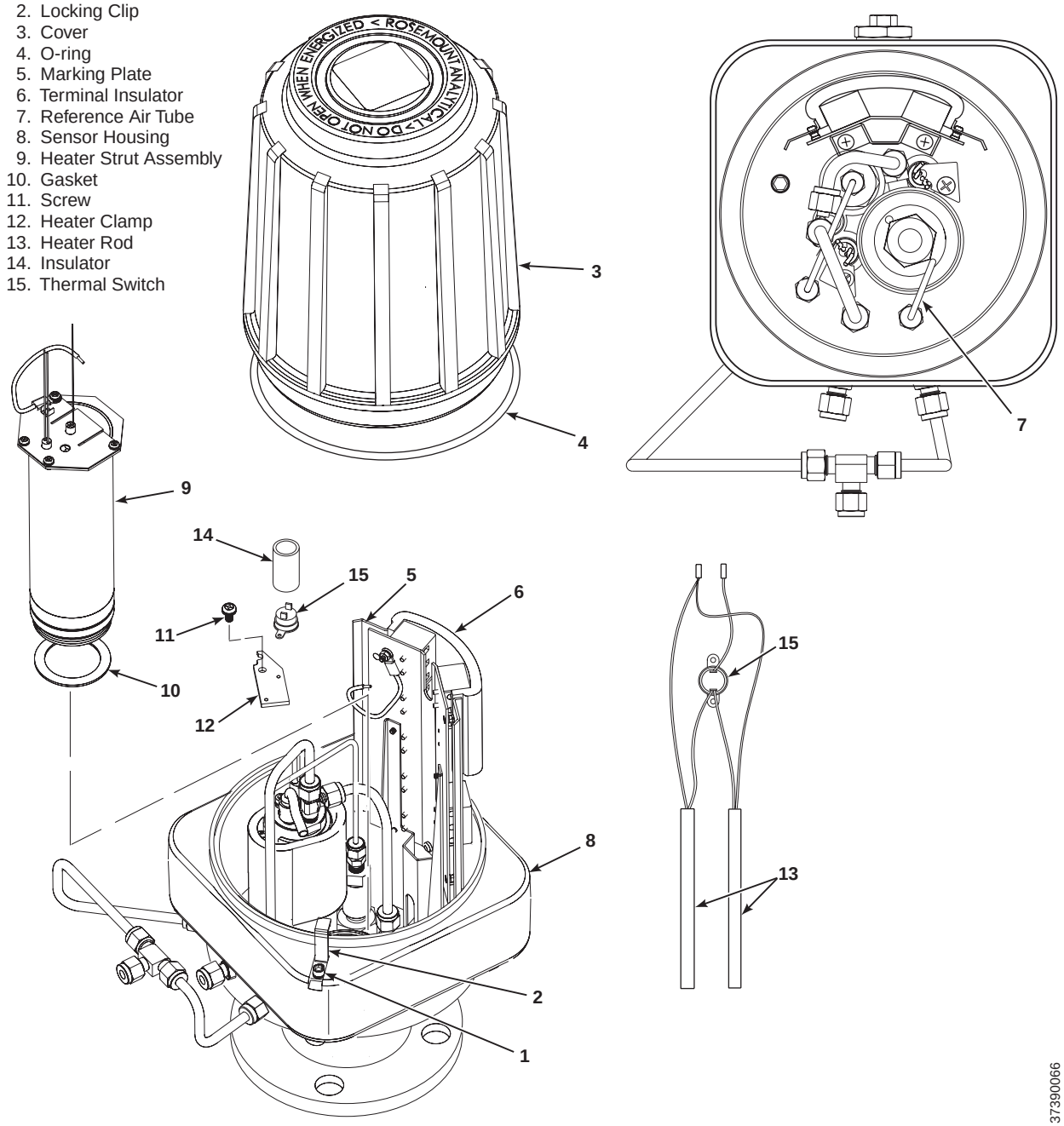


Figure 9-22. Installation of O_2 Cell and Heater Strut Assembly

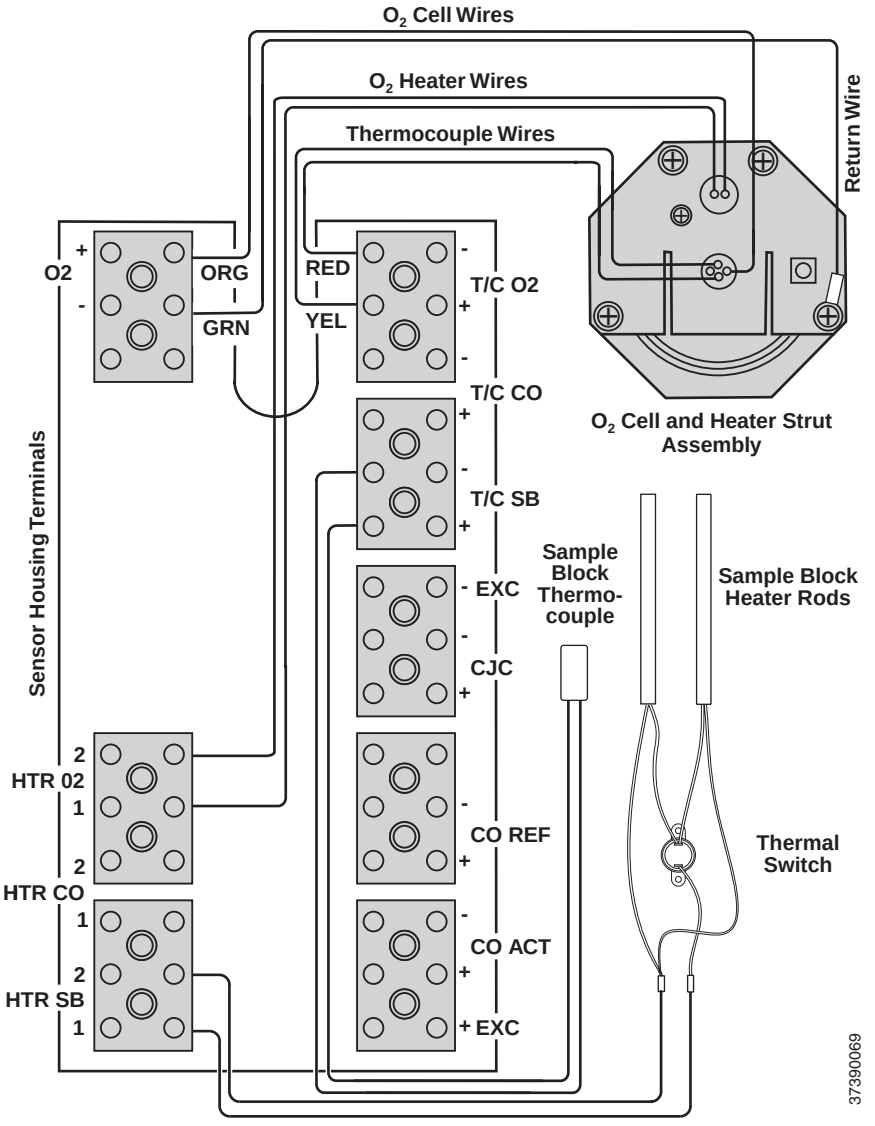
1. Screw
2. Locking Clip
3. Cover
4. O-ring
5. Marking Plate
6. Terminal Insulator
7. Reference Air Tube
8. Sensor Housing
9. Heater Strut Assembly
10. Gasket
11. Screw
12. Heater Clamp
13. Heater Rod
14. Insulator
15. Thermal Switch



Install Sample Block Heater Rods

1. Before installing sample block heater rods (13, Figure 9-22), evenly coat the heater rods with Watlube heater release agent.
2. Install the heater rods (13), heater clamps (12), and screws (11).
3. Reconnect the heater rod leads at the sensor housing terminal blocks, (Figure 9-23).

Figure 9-23. O_2 Cell, Thermocouple, and Heater Connections



Install O_2 Cell and Heater Strut Assembly

1. Rub a small amount of anti-seize compound on both sides of new gasket (10, Figure 9-22).
2. Apply anti-seize compound to threads of O_2 cell and heater strut assembly (9) and sensor housing (8).

⚠CAUTION

Stripped threads on the O_2 cell and heater strut assembly can allow gas leakage. Gas leakage can affect the O_2 measurements and calibration. Avoid over-tightening the O_2 cell and heater strut assembly.

3. Install O_2 cell and heater strut assembly (9) in sensor housing (8). Snug up, but do not over-tighten the assembly.
4. Reconnect the lead wires from O_2 cell, heater, and thermocouple to the sensor housing terminal blocks. Refer to Figure 9-23.
5. Install reference air tube (7, Figure 9-22) in sensor housing (8). Make sure that the open end of reference air tube extends into heater tube of O_2 cell and heater strut assembly (9).

Install Terminals Insulator and Cover

1. Install insulator (6, Figure 9-22) over uppermost terminal blocks. Position one side of insulator against terminal blocks and snap terminal marking plate (5) to mating stand-off.
2. Position opposite side of insulator (6) and secure with related marking plate (5).
3. If removed, install cover gasket (4). Screw cover (3) onto sensor housing (8). Tighten cover firmly.
4. Align locking clip (2) with gap between cover ribs.
5. Loosen screw (1) and slide locking clip (2) fully into gap between cover ribs. Retighten screw (1).

Sensor Housing Leak Test

1. Install 1/4 NPT cap on dilution air inlet fitting. Install a 1/4 NPT cap on sample tube (2, Figure 9-13) or plug 1/4 NPT sample inlet port. Capped or plugged ports must be air tight.
2. If not in place, install exhaust tube (3, Figure 9-13) in exhaust port according to the instructions provided.
3. Connect a calibrated manometer to the CAL GAS inlet port.
4. Connect and apply clean instrument air at 45 psig (310 kPa gage) to the instrument air inlet fitting.
5. Observe the manometer reading. The reading should be from 10 to 13 inches, Water Column. Locate and correct leaks if the reading is less than 10 inches WC.

REPAIR ELECTRONICS HOUSING

Use the following procedures to remove damaged components from the Hazardous Area OCX 8800 electronics housing and to install new replacement parts. Disassemble the unit only as needed to replace damaged components. Use the assembly procedures that apply to install replacement parts and reassemble the unit.

Electronics Housing Disassembly

Remove Cover

1. See Figure 9-24. Loosen screw (1) and slide locking clip (2) away from cover (3). Retighten screw (1).
2. With two hands or strap wrench, turn cover (3) counterclockwise to loosen. Unthread and remove cover.
3. Inspect cover gasket (4) for wear or damage. Replace cover gasket if damaged.

Remove Flash PROM

⚠CAUTION

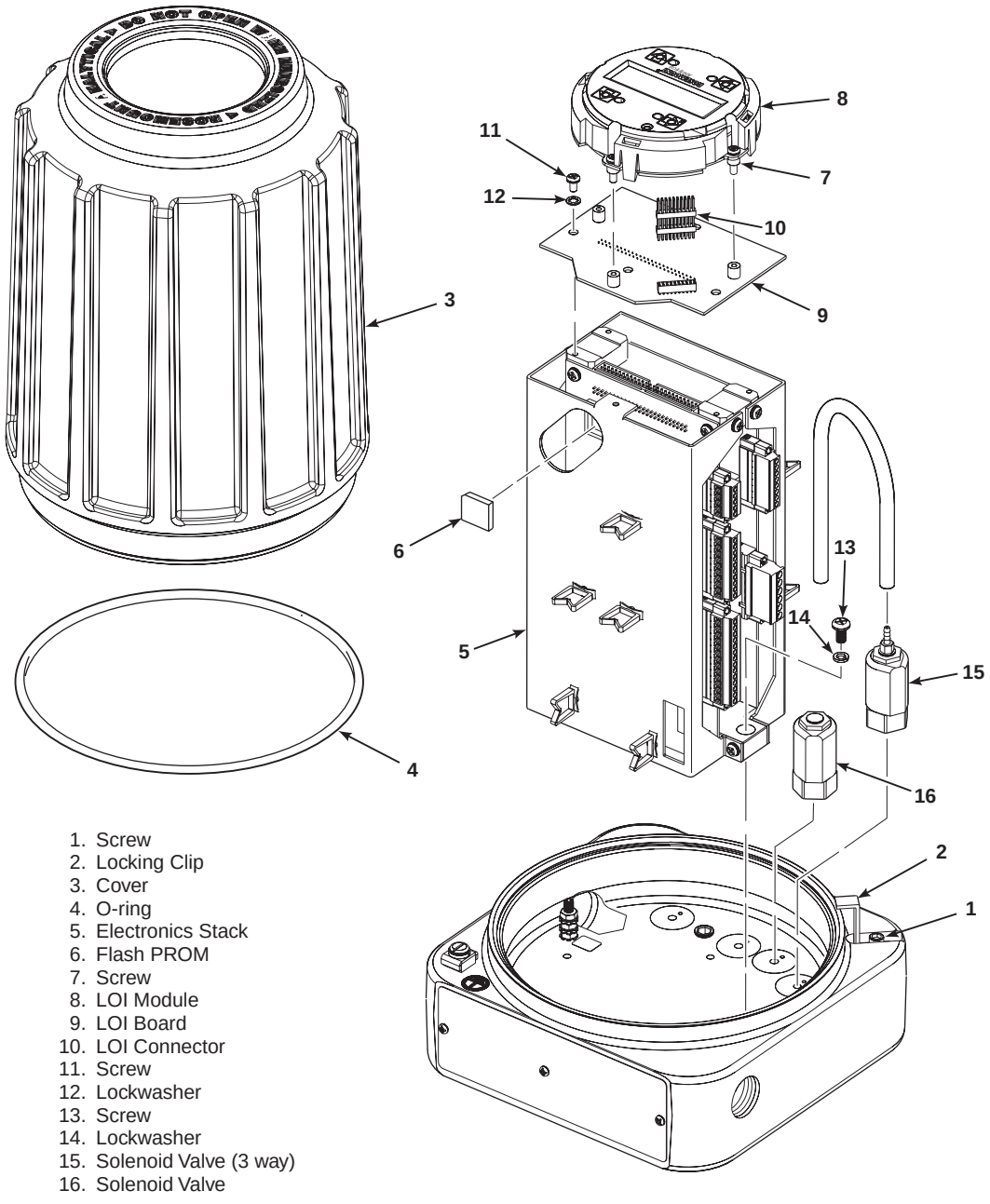
Electrostatic discharge (ESD) protection is required to avoid damage to the electronic circuits.

1. Locate Flash PROM access port in electronics stack (5, Figure 9-24).
2. Use suitable IC removal tool to remove Flash PROM (6).

Remove LOI Module and Board

1. Remove three screws (7, Figure 9-24).
2. Carefully lift LOI module (8) from LOI board (9). Note the location of LOI connector (10).
3. Remove two screws (11) and lockwashers (12). Remove LOI board (9).

Figure 9-24. Removal/Installation of Electronics Housing Components



1. Screw
2. Locking Clip
3. Cover
4. O-ring
5. Electronics Stack
6. Flash PROM
7. Screw
8. LOI Module
9. LOI Board
10. LOI Connector
11. Screw
12. Lockwasher
13. Screw
14. Lockwasher
15. Solenoid Valve (3 way)
16. Solenoid Valve

Remove Electronics Stack

1. Unplug power cable, signal cable, and solenoid lead connectors from terminals of electronics stack (5, Figure 9-24).
2. Remove two screws (13) and lockwashers (14).
3. Remove electronics stack (5).

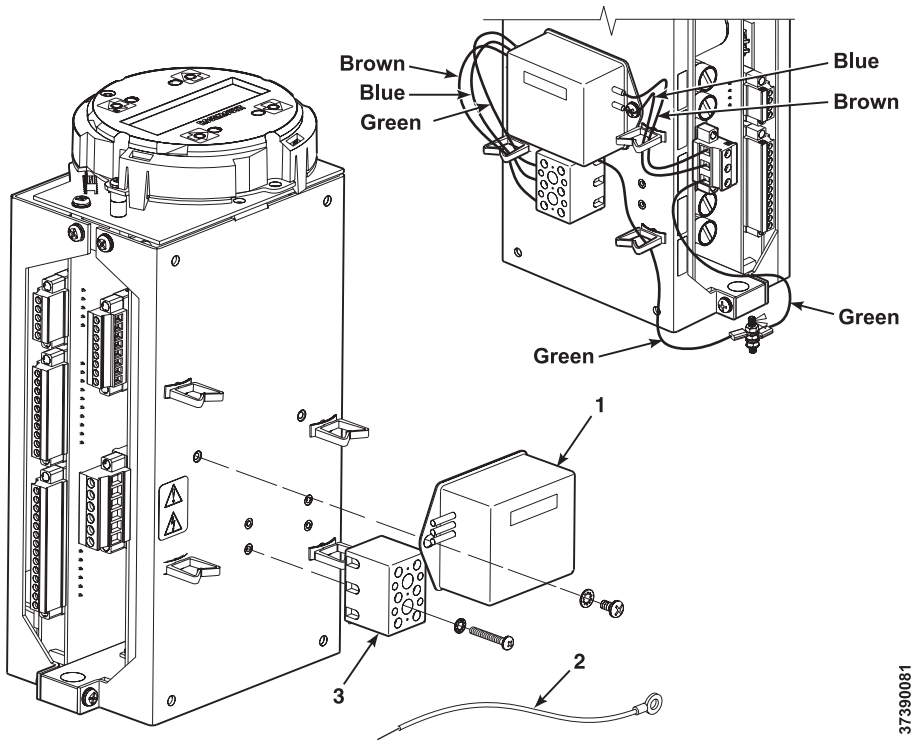
Remove Solenoid Valves

1. Disconnect solenoid leads from mating terminal connector.
2. Remove top nut of solenoid valve (15 or 16, Figure 9-24).
3. Remove the solenoid coil assembly and washer.
4. Unthread and remove solenoid valve base.

Remove EMI Filter and Terminal Block

1. Disconnect EMI filter wiring (Figure 9-25) at terminal block (3).
2. Disconnect EMI filter wiring at AC power input terminal block on electronic stack.
3. Unbolt and remove EMI filter (1) from electronic stack.
4. Remove ground wire (2) from terminal block (3).
5. Unbolt and remove terminal block (3) from electronic stack.

Figure 9-25. Removal/ Installation of EMI Filter



Electronics Housing Assembly

Install EMI Filter and Terminal Block

1. Install replacement EMI filter (1, Figure 9-25) and/or terminal block (3) on electronic stack.
2. Refer to wiring details in Figure 9-25. Connect EMI filter wiring and ground wire (2) at terminal block (3).
3. Connect EMI filter wiring at AC power input terminal block on electronic stack.

Install Solenoid Valves

1. Disassemble replacement solenoid valve (15 or 16, Figure 9-24).
2. Install new solenoid valve base. Be careful not to overtighten.
3. Install new washer and solenoid coil assembly and secure with nut.
4. Connect the solenoid leads to the proper terminations on the solenoid power terminal block (Figure 9-27).

Install Electronics Stack

1. Install electronics stack (5, Figure 9-24) and secure with lockwashers (14) and screws (13).
2. See Figure 9-26 and Figure 9-27. Reconnect power cable, signal cable, and solenoid lead connectors to electronics stack terminals.

Install LOI Module and Board

1. Install LOI board (9, Figure 9-24) and secure with two screws (11) and lockwashers (12).
2. Note the location of the LOI connector (10). Plug LOI module (8) and connector into one of the four mating receptacles provided.
3. Install three screws (7) to secure the LOI module.

Figure 9-26. Electronics Housing Cable Connections

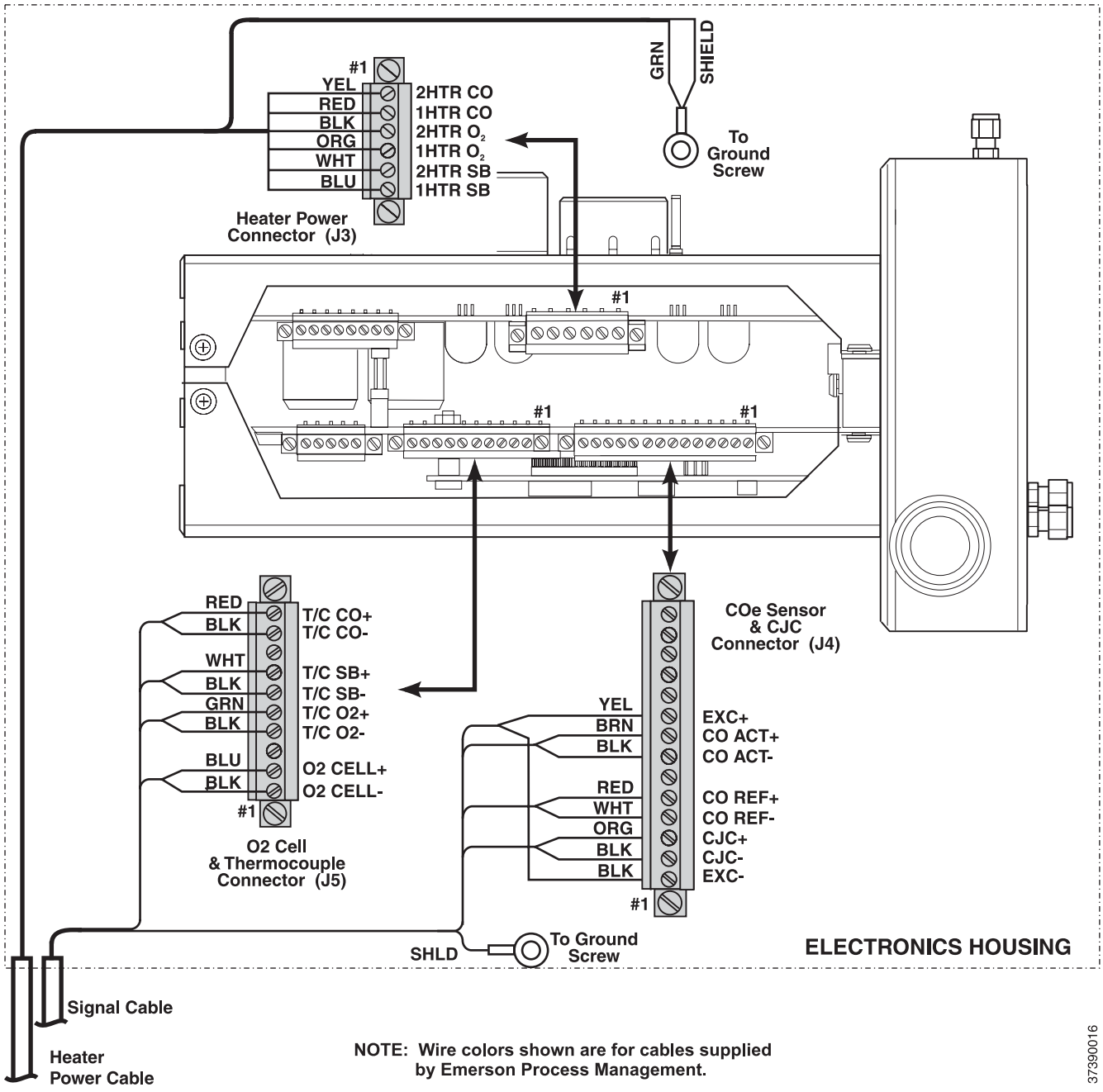
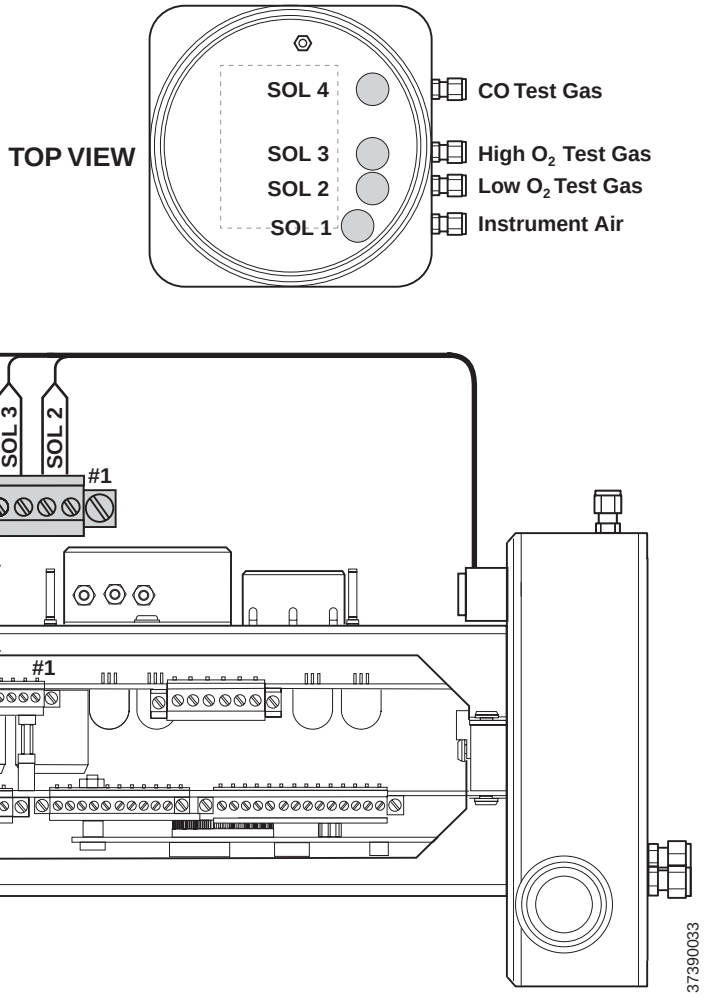


Figure 9-27. Solenoid Power Terminals



Install Cover

1. If removed, install cover gasket (4, Figure 9-24). Screw cover (3) onto electronics housing. Tighten cover firmly. Align locking clip (2) with gap between cover ribs.
2. Loosen screw (1) and slide locking clip (2) fully into gap between cover ribs. Retighten screw (1).

REPLACE TUBE FITTINGS

The OCX transmitter housings have special tube fittings that, if clogged or damaged, must be replaced with the same type of fitting. The special tube fittings have alpha or numeric codes etched on the fitting. Unetched tube fittings are standard 1/4 inch, stainless steel fittings.

'F' Type Fitting
The 'F' type fitting is a flame arrestor fitting used in all OCX 8800 hazardous area housings. The flame arrestor fitting prohibits spark or flame conduction from the housing. It requires a thread sealing compound (Loctite 567) and at least five threads engagement.

'13' Type Fitting
This fitting is an eductor drive air fitting for the OCX 8800 hazardous area housing. This is a 1/8 inch tube fitting with a built-in 0.013 inch restrictor orifice. It seats in a threaded base port inside the housing.

'R' Type Fitting
The 'R' type fitting is a reference air line fitting for the general purpose and hazardous area sensor housings. This is a 1/4 inch tube fitting with a built-in 0.007 inch restrictor orifice.

Remove Tube Fittings

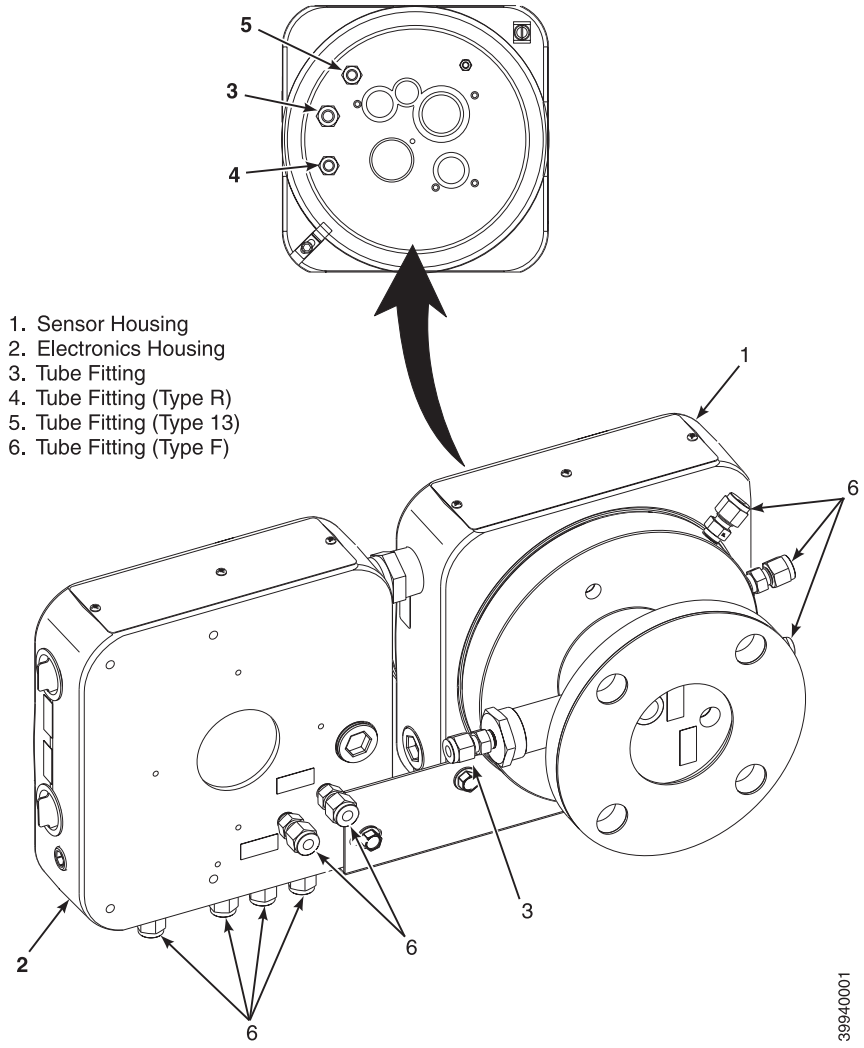
The OCX construction includes pipe thread sealant to seal fittings in all ports that pass through to an outer wall of the instrument housing base. Use the following instructions to loosen and remove tube fittings that are secured with pipe thread sealant.

⚠WARNING

Use heat resistant gloves when removing a damaged tube fitting. The pipe threads are bonded with a pipe thread sealant. The thread sealant softens at 450°F (232°C). The heated parts can cause severe burns.

1. Secure sensor housing (1, Figure 9-28) or electronics housing (2) in soft (plastic, wood, or brass) vice jaws.
2. To soften the pipe thread sealant, use a propane torch to heat the tube fitting (3, 4, 5, or 6) to 450°F (232°C), minimum.
3. While heating the tube fitting, use a wrench to apply removal torque until the pipe thread sealant softens. Remove and discard the used fitting.
4. Use MEK or methylene chloride solvent to clean thread sealant residue from the internal pipe threads in the housing. Refer to applicable MSDS sheet for solvent handling precautions.

Figure 9-28. Removal of Tube Fittings



Install Tube Fittings

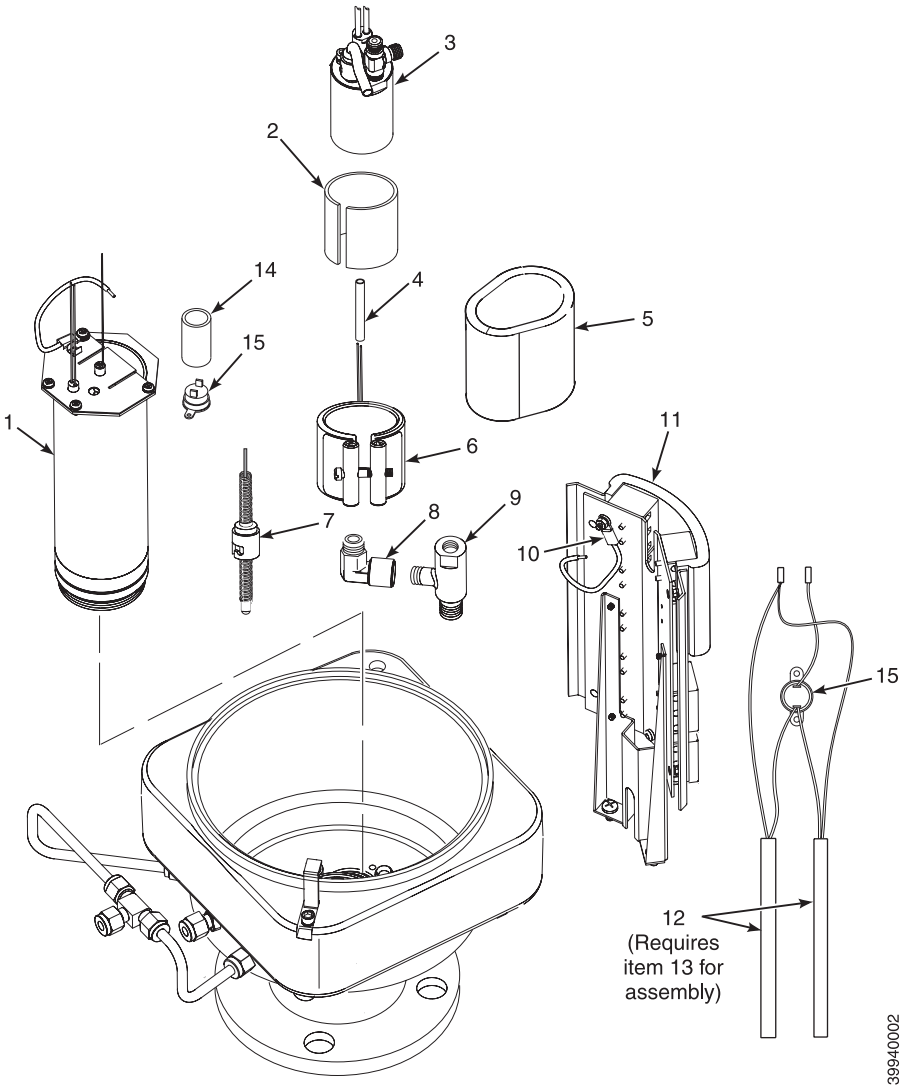
1. Verify that the replacement tube fitting is identical to the item removed. Special fittings are etched with code markings.
2. Apply pipe thread sealant (Loctite #567) to the mating threads of the tube fitting. Do not apply sealant to the first turn of the external pipe threads.
3. Install and tighten the tube fitting in the mating port of sensor or electronics housing.

Section 10 Replacement Parts

Sensor Housing . . . . . page 10-2
Electronics Housing . . . . . page 10-6
O2 Cell and Heater Strut Assembly . . . . . page 10-9

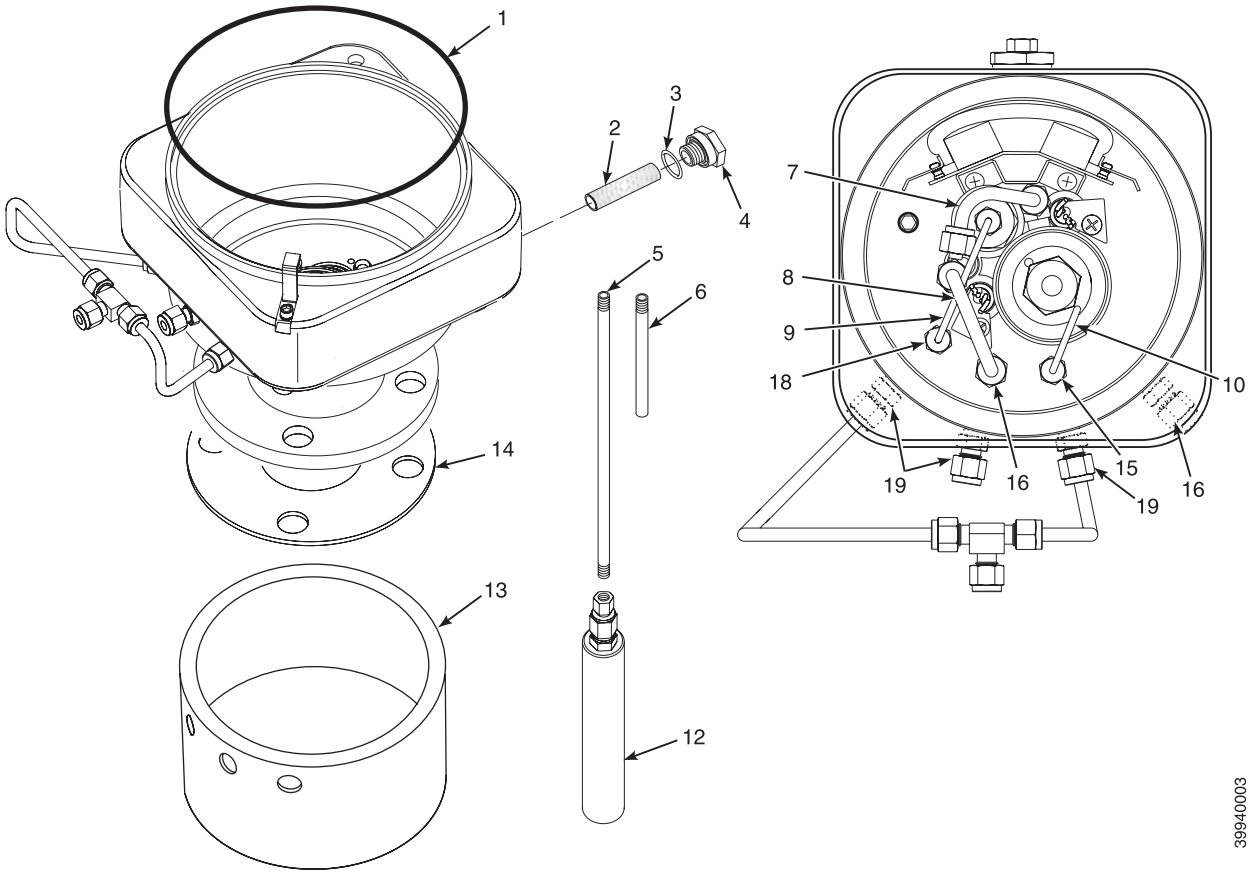
SENSOR HOUSING

Figure 10-1. Sensor Housing Components (Sheet 1 of 2)



Index No.	Part Number	Description
1	5R10190G02	O_2 Cell and Heater Assembly, Standard Cell
	5R10190G03	O_2 Cell and Heater Assembly, High Sulfur Cell
2	6P00177H01	Heater Insulator, Mica
3	4851B46G03	Combustibles Sensor Replacement Kit
4	1A99786H01	Heater Leads Insulator, 14.5 inches long
5	6P00163H01	COe Insulator
6	1A99746H02	Band Heater
7	1A99749H01	Thermocouple
8	1A99747H01	Elbow
9	5R10200H01	Eductor
10	6A00123G01	CJC Sensor (RTD assembly, ring type)
11	6P00155H02	Insulator
12	1A98765H02	Heater Rod (2 required)
13	1A99520H01	Watlube Heater Release Agent
14	9886A15H01	Thermal Switch Insulator
15	5R10268H02	Thermal Switch

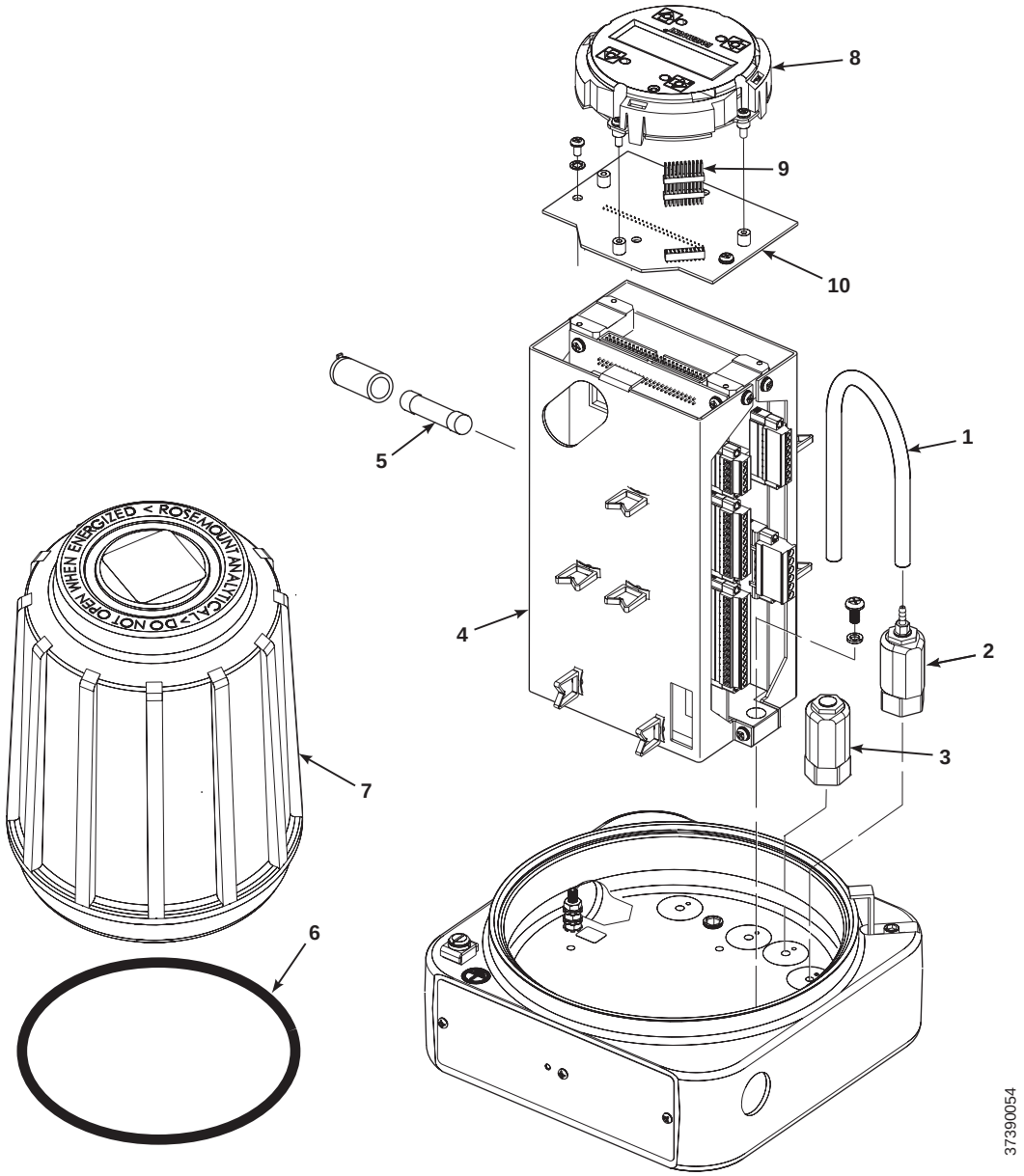
Figure 10-2. Sensor Housing Components (Sheet 2 of 2)



Index No.	Part Number	Description
1	1A99089H02	Cover Gasket (O-ring)
2	5R10246H06	Blowback Filter, 5 Micron, Stainless Steel
3	1A98448H02	O-ring
4	5R10247H01	Fitting
5	5R10183H02	Tube, Sample, 18 in. (457 mm) 316 Stainless steel
	5R10183H06	Tube, Sample, 18 in. (457 mm) Inconel 600
	5R10227G01	Tube, Sample, 18 in. (457 mm) Ceramic
	5R10183H03	Tube, Sample, 3 ft. (0.91 m) 316 Stainless steel
	5R10183H07	Tube, Sample, 3 ft. (0.91 m) Inconel 600
	5R10227G02	Tube, Sample, 3 ft. (0.91 m) Ceramic
	5R10183H04	Tube, Sample, 6 ft. (1.83 m) 316 Stainless steel
	5R10183H08	Tube, Sample, 6 ft. (1.83 m) Inconel 600
	5R10183H05	Tube, Sample, 9 ft. (2.7 m) 316 Stainless steel
	5R10183H09	Tube, Sample, 9 ft. (2.7 m) Inconel 600
6	5R10183H01	Tube, Exhaust
7	5R10185H07	COe Extractive Tube
8	5R10185H08	Dilution Air Tube
9	5R10185H03	Eductor Drive Air Tube
10	5R10185H04	Reference Air Tube
12	1A99762H02	In Situ Filter, 10 Micron (Stainless Steel Sample Tube only)
	1A99762H03	Hasteloy In Situ Filter, 10 Micron, High Temperature (Stainless Steel and Inconel Sample Tubes only)
	6P00349H01	In Situ Filter, 20 Micron, High Surface Area
13	6P00162H01	Flange Insulator (optional)
14	3535B18H02	Flange Gasket, ANSI
	3535B45H01	Flange Gasket, DIN
15	5R10279G01	Tube Fitting, Type "R"
16	771B870H04	Tube Fitting, Standard
18	5R10279G03	Tube Fitting, Type "13"
19	5R10267G01	Tube Fitting, Flame Arrestor, Type "F"

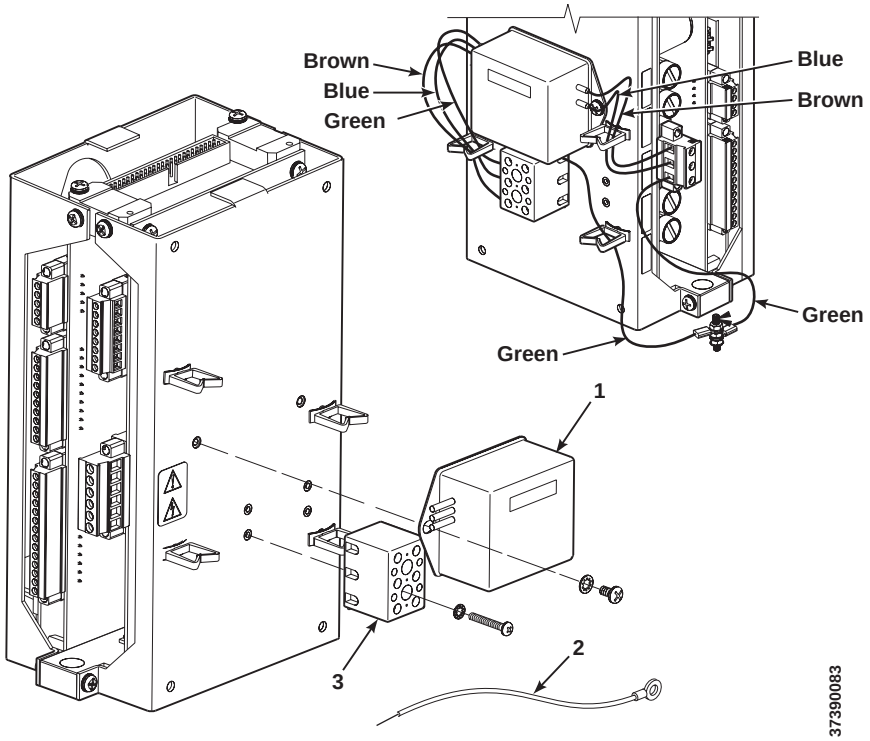
ELECTRONICS HOUSING

Figure 10-3. Electronics Housing Components



Index No.	Part Number	Description
1	1A97902H01	Hose
2	1A97905H02	Solenoid Valve, 3-Way
3	1A97905H01	Solenoid Valve, Test Gas
4	6A00132G01	Electronics Stack, HART
	6A00387G01	Electronics Stack, Fieldbus
5	1A97913H06	Fuse (F1 and F6), 10 Amp, 250 VAC
	1A99766H01	Fuse (F3), 4 Amp, 250 VAC
	1A99766H02	Fuse (F4), 8 Amp, 250 VAC
6	1A99089H02	Cover Gasket (O-ring)
7	5R10219G01	Cover, Blind
7A	5R10199G01	Cover, Window
8	6A00115G02	LOI Module
9	1A99112H05	LOI Connector
10	5R10235G01	LOI Board

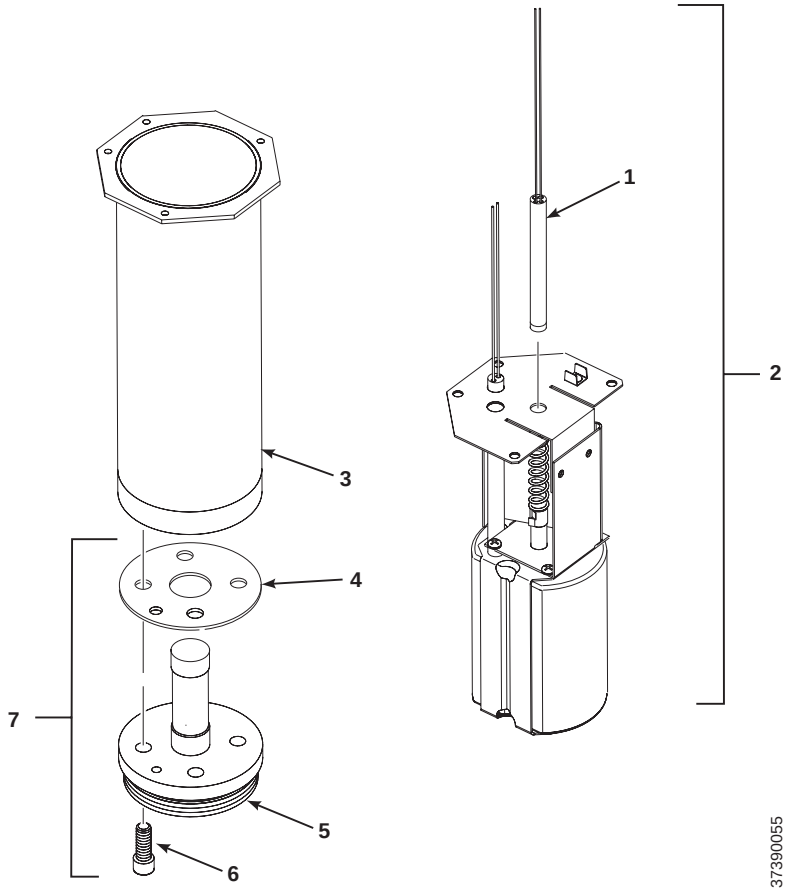
Figure 10-4. EMI Filter and Terminal Block



Index No.	Part Number	Description
1	1A98467H01	Filter, EMI
2	5R10238G01	Ground Wire
3	1A99714H01	Terminal Block

O_2 CELL AND HEATER STRUT ASSEMBLY

Figure 10-5. O_2 Cell and Heater Strut Assembly



Index No.	Part Number	Description
1	4851B44G01	Contact and Thermocouple Assembly
2	5R10211G02	Heater Strut Assembly
3	Ref	Heater Tube
4	Ref	Gasket (part of O_2 Cell Replacement Kit, item 7)
5	Ref	O_2 Cell (part of O_2 Cell Replacement Kit, item 7)
6	Ref	Screw (part of O_2 Cell Replacement Kit, item 7)
7	4851B45G01	O_2 Cell Replacement Kit, Standard Sensing Cell
	4851B45G03	O_2 Cell Replacement Kit, High Sulfur Cell

Appendix A Safety Data

Safety Instructions . . . . . page A-2
Safety Data Sheet for Ceramic Fiber Products . . . . . page A-24
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Atex Clarification . . . . . page A-31

SAFETY INSTRUCTIONS

IMPORTANT

SAFETY INSTRUCTIONS FOR THE WIRING AND INSTALLATION OF THIS APPARATUS

The following safety instructions apply specifically to all EU member states. They should be strictly adhered to in order to assure compliance with the Low Voltage Directive. Non-EU states should also comply with the following unless superseded by local or National Standards.

1. Adequate earth connections should be made to all earthing points, internal and external, where provided.
2. After installation or troubleshooting, all safety covers and safety grounds must be replaced. The integrity of all earth terminals must be maintained at all times.
3. Mains supply cords should comply with the requirements of IEC227 or IEC245.
4. All wiring shall be suitable for use in an ambient temperature of greater than 75°C.
5. All cable glands used should be of such internal dimensions as to provide adequate cable anchorage.
6. To ensure safe operation of this equipment, connection to the mains supply should only be made through a circuit breaker which will disconnect all circuits carrying conductors during a fault situation. The circuit breaker may also include a mechanically operated isolating switch. If not, then another means of disconnecting the equipment from the supply must be provided and clearly marked as such. Circuit breakers or switches must comply with a recognized standard such as IEC947. All wiring must conform with any local standards.
7. Where equipment or covers are marked with the symbol to the right, hazardous voltages are likely to be present beneath. These covers should only be removed when power is removed from the equipment - and then only by trained service personnel.

8. Where equipment or covers are marked with the symbol to the right, there is a danger from hot surfaces beneath. These covers should only be removed by trained service personnel when power is removed from the equipment. Certain surfaces may remain hot to the touch.

9. Where equipment or covers are marked with the symbol to the right, refer to the Operator Manual for instructions.

10. All graphical symbols used in this product are from one or more of the following standards: EN61010-1, IEC417, and ISO3864.
11. Where equipment or labels are marked "Do Not Open While Energized" or similar, there is a danger of ignition in areas where an explosive atmosphere is present. This equipment should only be opened when power is removed and adequate time as specified on the label or in the instruction manual has been allowed for the equipment to cool down - and then only by trained service personnel.

DŮLEŽITÉ

Bezpečnostní pokyny pro zapojení a instalaci zařízení

Následující bezpečnostní pokyny se speciálně vztahují na všechny členské státy EU. Pokyny by měly být přísně dodržovány, aby se zajistilo splnění Směrnice o nízkém napětí. Pokud nejsou pokyny nahrazeny místními či národními normami, měly by je dodržovat i nečlenské státy EU.

1. U všech zemnicích bodů, interních a externích, by mělo být vytvořeno odpovídající uzemnění.
2. Po instalaci nebo odstranění problémů musí být vyměněny všechny bezpečnostní kryty a uzemnění. Vždy musí být zajištěna integrita všech zemnicích svorek.
3. Sí˙ové kabely by měly odpovídat požadavkům normy IEC227 nebo IEC245.
4. Všechna zapojení by měla být vhodná pro použití při vnějších teplotách nad 75 °C.
5. Všechna použitá kabelová hrdla by měla mít takové vnitřní rozměry, aby zajistila odpovídající zakotvení kabelu.
6. Správnou činnost zařízení zajistíte, vytvoříte-li připojení k napájecímu zdroji pouze přes jistič, který v případě poruchy odpojí všechny obvody s konduktory. Jistič může také obsahovat mechanický odpojovač. Pokud ho neobsahuje, musí být zajištěn a jasně označen jiný způsob odpojení zařízení od zdroje. Jističe nebo přepínače musí odpovídat uznávaným normám, např. IEC947. Všechna zapojení musí odpovídat místním normám.
7. Je-li zařízení nebo kryt označen symbolem na pravé straně, pravděpodobně se uvnitř nachází nebezpečné napětí. Tyto kryty by měly být sejmuty pouze po odpojení zařízení od zdroje - a to pouze kvalifikovaným zaměstnancem.

8. Je-li zařízení nebo kryt označen symbolem na pravé straně, povrch zařízení může být velmi horký. Tyto kryty by měly být sejmuty pouze kvalifikovaným zaměstnancem po odpojení zařízení od zdroje. Některé povrchy mohou být stále horké.

9. Je-li zařízení nebo kryt označen symbolem na pravé straně, přečtěte si nejprve instrukce v návodu k obsluze.

10. Všechny grafické symboly používané u výrobku pocházejí z následujících norem: EN61010-1, IEC417 a ISO3864.
11. Pokud je zařízení nebo štítky označeno varováním „Je-li zařízení pod napětím, neotvírejte jej“ či podobným, může dojít ve výbušném prostředí ke vznícení. Zařízení lze otevřít pouze po jeho odpojení od zdroje a ponechání dostatečného času na vychladnutí, jak je uvedeno na štítku nebo v návodu k obsluze - a to pouze kvalifikovaným zaměstnancem.

VIGTIGT

Sikkerhedsinstruktion for tilslutning og installering af dette udstyr.

Følgende sikkerhedsinstruktioner gælder specifikt i alle EU-medlemslande. Instruktionerne skal nøje følges for overholdelse af Lavsspændingsdirektivet og bør også følges i ikke EU-lande medmindre andet er specificeret af lokale eller nationale standarder.

1. Passende jordforbindelser skal tilsluttes alle jordklemmer, interne og eksterne, hvor disse forefindes.
2. Efter installation eller fejlfinding skal alle sikkerhedsdæksler og jordforbindelser reetableres.
3. Forsyningskabler skal opfylde krav specificeret i IEC227 eller IEC245.
4. Alle ledningstilslutninger skal være konstrueret til omgivelsestemperatur højere end 75°C.
5. Alle benyttede kabelforskruninger skal have en intern dimension, så passende kabelaflastning kan etableres.
6. For opnåelse af sikker drift og betjening skal der skabes beskyttelse mod indirekte berøring gennem afbryder (min. 10A), som vil afbryde alle kredsløb med elektriske ledere i fejlsitua-tion. Afbryderen skal indholde en mekanisk betjent kontakt. Hvis ikke skal anden form for afbryder mellem forsyning og udstyr benyttes og mærkes som sådan. Afbrydere eller kontakter skal overholde en kendt standard som IEC947.
7. Hvor udstyr eller dæksler er mærket med dette symbol, er farlige spændinger normalt forekom-mende bagved. Disse dæksler bør kun afmonteres, når forsyningsspændingen er frakoblet - og da kun af instrueret servicepersonale.

8. Hvor udstyr eller dæksler er mærket med dette symbol, forefindes meget varme overflader bagved. Disse dæksler bør kun afmonteres af instrueret servicepersonale, når forsyningsspænding er frakoblet. Visse overflader vil stadig være for varme at berøre i op til 45 minutter efter frakobling.

9. Hvor udstyr eller dæksler er mærket med dette symbol, se da i betjeningsmanual for instruktion.

10. Alle benyttede grafiske symboler i dette udstyr findes i én eller flere af følgende standarder:- EN61010-1, IEC417 & ISO3864.
11. Når udstyr eller etiketter er mærket "Må ikke åbnes, mens udstyret tilføres strøm" eller lignende, er der fare for antændelse i områder, hvor der er en eksplosiv atmosfære. Dette udstyr må kun åbnes, når strømkilden er fjernet, og der er gået tilstrækkelig tid til, at udstyret er kølet ned. Den nødvendige tid hertil er angivet på etiketten eller i brugervejledningen. Udstyret må kun åbnes af en faglært person.

BELANGRIJK

Veiligheidsvoorschriften voor de aansluiting en installatie van dit toestel.

De hierna volgende veiligheidsvoorschriften zijn vooral bedoeld voor de EU lidstaten. Hier moet aan gehouden worden om de onderworpenheid aan de Laag Spannings Richtlijn (Low Voltage Directive) te verzekeren. Niet EU staten zouden deze richtlijnen moeten volgen tenzij zij reeds achterhaald zouden zijn door plaatselijke of nationale voorschriften.

1. Degelijke aardingsaansluitingen moeten gemaakt worden naar alle voorziene aardpunten, intern en extern.
2. Na installatie of controle moeten alle veiligheidsdeksels en -aardingen terug geplaatst worden. Ten alle tijde moet de betrouwbaarheid van de aarding behouden blijven.
3. Voedingskabels moeten onderworpen zijn aan de IEC227 of de IEC245 voorschriften.
4. Alle bekabeling moet geschikt zijn voor het gebruik in omgevingstemperaturen, hoger dan 75°C.
5. Alle wartels moeten zo gedimensioneerd zijn dat een degelijke kabel bevestiging verzekerd is.
6. Om de veilige werking van dit toestel te verzekeren, moet de voeding door een stroomonderbreker gevoerd worden (min 10A) welke alle draden van de voeding moet onderbreken. De stroomonderbreker mag een mechanische schakelaar bevatten. Zoniet moet een andere mogelijkheid bestaan om de voedingsspanning van het toestel te halen en ook duidelijk zo zijn aangegeven. Stroomonderbrekers of schakelaars moeten onderworpen zijn aan een erkende standaard zoals IEC947.
7. Waar toestellen of deksels aangegeven staan met het symbool is er meestal hoogspanning aanwezig. Deze deksels mogen enkel verwijderd worden nadat de voedingsspanning werd afgelegd en enkel door getraind onderhoudspersoneel.

8. Waar toestellen of deksels aangegeven staan met het symbool is er gevaar voor hete oppervlakken. Deze deksels mogen enkel verwijderd worden door getraind onderhoudspersoneel nadat de voedingsspanning verwijderd werd. Sommige oppper-vlakken kunnen 45 minuten later nog steeds heet aanvoelen.

9. Waar toestellen of deksels aangegeven staan met het symbool gelieve het handboek te raadplegen.

10. Alle grafische symbolen gebruikt in dit produkt, zijn afkomstig uit een of meer van devolgende standaards: EN61010-1, IEC417 en ISO3864.
11. Op plaatsen waar uitrusting of etiketten zijn voorzien van een melding als "Niet openen bij aanwezigheid van spanning" bestaat er brandgevaar in omgevingen waar een explosieve atmosfeer aanwezig is. Deze uitrusting mag uitsluitend worden geopend wanneer het niet meer onder spanning staat en de uitrusting gedurende de voorgeschreven tijd op het etiket of in de handleiding is afgekoeld - en dan uitsluitend door voldoende opgeleid onderhoudspersoneel.

BELANGRIJK

Veiligheidsinstructies voor de bedrading en installatie van dit apparaat.

Voor alle EU lidstaten zijn de volgende veiligheidsinstructies van toepassing. Om aan de geldende richtlijnen voor laagspanning te voldoen dient men zich hieraan strikt te houden. Ook niet EU lidstaten dienen zich aan het volgende te houden, tenzij de lokale wetgeving anders voorschrijft.

1. Alle voorziene interne- en externe aardaansluitingen dienen op adequate wijze aangesloten te worden.
2. Na installatie, onderhouds- of reparatie werkzaamheden dienen alle beschermdeksels /kappen en aardingen om reden van veiligheid weer aangebracht te worden.
3. Voedingskabels dienen te voldoen aan de vereisten van de normen IEC 227 of IEC 245.
4. Alle bedrading dient geschikt te zijn voor gebruik bij een omgevings temperatuur boven 75°C.
5. Alle gebruikte kabelwartels dienen dusdanige inwendige afmetingen te hebben dat een adequate verankering van de kabel wordt verkregen.
6. Om een veilige werking van de apparatuur te waarborgen dient de voeding uitsluitend plaats te vinden via een meerpolige automatische zekering (min.10A) die alle spanningvoerende geleiders verbreekt indien een foutconditie optreedt. Deze automatische zekering mag ook voorzien zijn van een mechanisch bediende schakelaar. Bij het ontbreken van deze voorziening dient een andere als zodanig duidelijk aangegeven mogelijkheid aanwezig te zijn om de spanning van de apparatuur af te schakelen. Zekeringen en schakelaars dienen te voldoen aan een erkende standaard zoals IEC 947.
7. Waar de apparatuur of de beschermdeksels/kappen gemarkeerd zijn met het volgende symbool, kunnen zich hieronder spanning voerende delen bevinden die gevaar op kunnen leveren. Deze beschermdeksels/ kappen mogen uitsluitend verwijderd worden door getraind personeel als de spanning is afgeschakeld.

8. Waar de apparatuur of de beschermdeksels/kappen gemarkeerd zijn met het volgende symbool, kunnen zich hieronder hete oppervlakken of onderdelen bevinden. Bepaalde delen kunnen mogelijk na 45 min. nog te heet zijn om aan te raken.

9. Waar de apparatuur of de beschermdeksels/kappen gemarkeerd zijn met het volgende symbool, dient men de bedieningshandleiding te raadplegen.

10. Alle grafische symbolen gebruikt bij dit produkt zijn volgens een of meer van de volgende standaarden: EN 61010-1, IEC 417 & ISO 3864.
11. Op plaatsen waar uitrusting of etiketten zijn voorzien van een melding als "Niet openen bij aanwezigheid van spanning" bestaat er brandgevaar in omgevingen waar een explosieve atmosfeer aanwezig is. Deze uitrusting mag uitsluitend worden geopend wanneer het niet meer onder spanning staat en de uitrusting gedurende de voorgeschreven tijd op het etiket of in de handleiding is afgekoeld - en dan uitsluitend door voldoende opgeleid onderhoudspersoneel.

WICHTIG

Sicherheitshinweise für den Anschluß und die Installation dieser Geräte.

Die folgenden Sicherheitshinweise sind in allen Mitgliederstaaten der europäischen Gemeinschaft gültig. Sie müssen strickt eingehalten werden, um der Niederspannungsrichtlinie zu genügen. Nichtmitgliedsstaaten der europäischen Gemeinschaft sollten die national gültigen Normen und Richtlinien einhalten.

1. Alle intern und extern vorgesehenen Erdungen der Geräte müssen ausgeführt werden.
2. Nach Installation, Reparatur oder sonstigen Eingriffen in das Gerät müssen alle Sicherheitsabdeckungen und Erdungen wieder installiert werden. Die Funktion aller Erdverbindungen darf zu keinem Zeitpunkt gestört sein.
3. Die Netzspannungsversorgung muß den Anforderungen der IEC227 oder IEC245 genügen.
4. Alle Verdrahtungen sollten mindestens bis 75°C ihre Funktion dauerhaft erfüllen.
5. Alle Kabeldurchführungen und Kabelverschraubungen sollten in Ihrer Dimensionierung so gewählt werden, daß diese eine sichere Verkabelung des Gerätes ermöglichen.
6. Um eine sichere Funktion des Gerätes zu gewährleisten, muß die Spannungsversorgung über mindestens 10 A abgesichert sein. Im Fehlerfall muß dadurch gewährleistet sein, daß die Spannungsversorgung zum Gerät bzw. zu den Geräten unterbrochen wird. Ein mechanischer Schutzschalter kann in dieses System integriert werden. Falls eine derartige Vorrichtung nicht vorhanden ist, muß eine andere Möglichkeit zur Unterbrechung der Spannungszufuhr gewährleistet werden mit Hinweisen deutlich gekennzeichnet werden. Ein solcher Mechanismus zur Spannungsunterbrechung muß mit den Normen und Richtlinien für die allgemeine Installation von Elektrogeräten, wie zum Beispiel der IEC947, übereinstimmen.

7. Mit dem Symbol sind Geräte oder Abdeckungen gekennzeichnet, die eine gefährliche (Netzspannung) Spannung führen. Die Abdeckungen dürfen nur entfernt werden, wenn die Versorgungsspannung unterbrochen wurde. Nur geschultes Personal darf an diesen Geräten Arbeiten ausführen.

8. Mit dem Symbol sind Geräte oder Abdeckungen gekennzeichnet, in bzw. unter denen heiße Teile vorhanden sind. Die Abdeckungen dürfen nur entfernt werden, wenn die Versorgungsspannung unterbrochen wurde. Nur geschultes Personal darf an diesen Geräten Arbeiten ausführen. Bis 45 Minuten nach dem Unterbrechen der Netzzufuhr können derartig Teile noch über eine erhöhte Temperatur verfügen.

9. Mit dem Symbol sind Geräte oder Abdeckungen gekennzeichnet, bei denen vor dem Eingriff die entsprechenden Kapitel im Handbuch sorgfältig durchgelesen werden müssen.
10. Alle in diesem Gerät verwendeten graphischen Symbole entspringen einem oder mehreren der nachfolgend aufgeführten Standards: EN61010-1, IEC417 & ISO3864.
11. Wenn Geräte oder Etiketten mit dem Hinweis "Nicht unter Spannung öffnen" oder ähnlichen Hinweisen versehen sind, besteht in explosionsgefährdeten Umgebungen Entzündungsgefahr. Das Gerät darf nur geöffnet werden, wenn es nicht ans Stromnetz angeschlossen und entsprechend der Zeitangaben auf dem Etikett bzw. in der Betriebsanleitung ausreichend abgekühlt ist. Das Gerät darf nur von geschultem Service-Personal geöffnet werden.

ΣΗΜΑΝΤΙΚΟ

Οδηγιεσ ασφαλειασ για την καλωδιωση και εγκατασταση τησ συσκευησ

Οι ακόλουθες οδηγίες ασφαλείας εφαρμόζονται ειδικά για όλες τις χώρες μέλη της Ευρωπαϊκής Κοινότητας. Θα πρέπει να ακολουθούνται αυστηρά ώστε να εξασφαλιστεί η συμβατότητα με τις οδηγίες για τη Χαμηλή Τάση. Χώρες που δεν είναι μέλη της Ευρωπαϊκής Κοινότητας θα πρέπει επίσης να ακολουθούν τις οδηγίες, εκτός εάν αυτές αντικαθίστανται από τα Τοπικά ή Εθνικά πρότυπα.

1. Επαρκείς συνδέσεις γείωσης θα πρέπει να γίνονται σε όλα τα σημεία γείωσης, εσωτερικά και εξωτερικά, όπου υπάρχουν.
2. Μετά την εγκατάσταση ή την αντιμετώπιση σφαλμάτων, όλα τα καλύμματα ασφαλείας και οι γειώσεις ασφαλείας πρέπει να επανεγκαθίστανται. Η καλή κατάσταση όλων των ακροδεκτών γείωσης πρέπει να συντηρείται διαρκώς.
3. Τα καλώδια τροφοδοσίας πρέπει να πληρούν τις απαιτήσεις των IEC227 ή IEC245.
4. Όλες οι καλωδιώσεις θα πρέπει να είναι κατάλληλες για χρήση σε θερμοκρασία χώρου υψηλότερη από 75°C.
5. Όλοι οι στυπιοθλίπτες θα πρέπει να είναι τέτοιων εσωτερικών διαστάσεων, ώστε να παρέχουν επαρκή στερέωση των καλωδίων.
6. Για τη διασφάλιση ασφαλούς λειτουργίας αυτής της συσκευής, η σύνδεση τροφοδοσίας θα πρέπει να γίνεται μόνο μέσω ασφαλειοδιακόπτη, ο οποίος θα αποσυνδέει όλους τους ηλεκτροφόρους αγωγούς των κυκλωμάτων, στη διάρκεια κατάστασης σφάλματος. Ο ασφαλειοδιακόπτης μπορεί επίσης να περιλαμβάνει μηχανικό διακόπτη απομόνωσης. Εάν δεν περιλαμβάνει, τότε άλλα μέσα αποσύνδεσης της συσκευής από την τροφοδοσία πρέπει να παροχηθούν και να σημανθούν σαφώς ως τέτοια. Οι ασφαλειοδιακόπτες ή διακόπτες πρέπει να συμμορφώνονται με αναγνωρισμένα πρότυπα όπως το IEC947. Όλες οι καλωδιώσεις πρέπει να συμμορφώνονται με τα τοπικά πρότυπα.
7. Όπου συσκευές ή καλύμματα είναι σημασμένα με το σύμβολο που εικονίζεται δεξιά, επικίνδυνες τάσεις ενυπάρχουν κάτω από αυτά. Αυτά τα καλύμματα θα πρέπει να αφαιρούνται μόνο όταν έχει αφαιρεθεί η τροφοδοσία από τη συσκευή - και στην περίπτωση αυτή, μόνο από ειδικευμένο τεχνικό προσωπικό.

8. Όπου συσκευές ή καλύμματα είναι σημασμένα με το σύμβολο που εικονίζεται δεξιά, υπάρχει κίνδυνος από καυτές επιφάνειες κάτω από αυτά. Τέτοια καλύμματα θα πρέπει να αφαιρούνται μόνο από ειδικευμένο τεχνικό προσωπικό, όταν έχει αφαιρεθεί η τροφοδοσία από τη συσκευή. Κάποιες επιφάνειες μπορούν να παραμένουν ζεστές στην αφή.

9. Όπου συσκευές ή καλύμματα είναι σημασμένα με το σύμβολο που εικονίζεται δεξιά, ανατρέξτε στις οδηγίες χρήσης της συσκευής.

10. Όλα τα γραφικά σύμβολα που χρησιμοποιούνται σε αυτό το προϊόν είναι από ένα ή περισσότερα από τα εξής πρότυπα: EN61010-1, IEC417 και ISO3864.
11. Όπου συσκευή ή ετικέτα είναι σημασμένη με την ένδειξη "Μην ανοίγετε ενώ βρίσκεται σε λειτουργία" ή άλλη παρόμοια, υπάρχει κίνδυνος ανάφλεξης σε περιοχές με εκρηκτική ατμόσφαιρα. Ο παρών εξοπλισμός πρέπει να ανοίγεται μόνο όταν είναι εκτός ρεύματος και αφού παρέλθει ο κατάλληλος χρόνος που αναγράφεται στην ετικέτα ή στο εγχειρίδιο οδηγιών ώστε να ψυχθεί και μόνο από εκπαιδευμένο προσωπικό συντήρησης.

OLULINE TEAVE

Juhtmestiku ja seadme paigaldamisega seotud ohutusjuhised

Alljärgnevad ohutusjuhised rakenduvad eriti kõigi Euroopa Liidu liikmesriikide suhtes. Antud juhiseid tuleb täpselt järgida, et kindlustada vastavus madalpinge direktiiviga. Euroopa Liitu mittekuuluvad riigid peavad samuti alljärgnevaid juhiseid järgima, va juhul, kui on olemas vastavad kohalikud riiklikud standardid.

1. Ettenähtud maanduspunktide, nii sisemiste kui väliste jaoks tuleb tagada nõuetekohased maaühendused.
2. Pärast paigaldamist või rikketuvastust tuleb kõik turvaümbrised ja turvamaandused uuesti oma kohale seada. Kõigis olukordades tuleb säilitada kõigi maandusklemmide terviklikkus.
3. Toitejuhtmed peavad vastama IEC227 või IEC245 nõuetele.
4. Kogu juhtmestik peab sobima kasutamiseks üle 75°C õhutemperatuuri juures.
5. Kõik juhtmetihendid peavad sisemõõtmete poolest tagama nõuetekohased kaabliühendused.
6. Seadme ohutu töötamise tagamiseks peab ühendus toiteallikaga toimuma vaid läbi automaatkorgi, mis veaolukorras lülitab välja kõik voolukandjad. Automaatkorgil võib olla ka mehhaaniliselt reguleeritav lahklüliti. Vastasel juhul peab seadme toiteallikast lahtiühendamiseks olema teine ja selgelt osutatud moodus. Automaatkorgid või -lülitid peavad vastama tunnustatud standarditele nagu nt IEC947. Kogu juhtmestik peab vastama kohalikele standarditele.
7. Seadmel või ümbristel asuv paremale osutav sümbol tähistab selle all leiduvat ohtlikku pinget. Selliste sümbolitega ümbriseid võib eemaldada vaid juhul, kui seade on toiteallikast lahti ühendatud ning ka siis ainult vastavate oskustega spetsialisti poolt.

8. Seadmele või ümbristele märgitud paremale osutava sümboli all valitseb kuumadest pindadest tulenev oht. Nimetatud sümbolitega ümbriseid võib eemaldada vaid vastavate oskustega spetsialist, kui seade on toiteallikast lahti ühendatud. Teatud pinnad võivad puudutamise jaoks liiga kuumad olla.

9. Seadmel või ümbristel leiduva paremale osutava sümboli korral vt juhiste jaoks Toimimisjuhendit.

10. Kõik selle toote juures kasutatavad graafilised sümbolid lähtuvad ühest või enamast järgmistest standarditest: EN61010-1, IEC417 ja ISO3864.
11. Kui seadmele või siltidele on kirjutatud "Ärge avage voolutarbimine korral" vms, valitseb plahvatusohtlikus keskkonnas süttimise oht. Seadet võib avada ainult siis, kui toide on lahti ühendatud ning seadmel on võimaldatud sildil või kasutusjuhendis osutatud aja jooksul maha jahtuda -- ning ka sellisel juhul ainult vastavate oskustega spetsialisti poolt.

TÄRKEÄÄ

Turvallisuusohje, jota on noudatettava tämän laitteen asentamisessa ja kaapeloinnissa.

Seuraavat ohjeet pätevät erityisesti EU:n jäsenvaltioissa. Niitä täytyy ehdottomasti noudattaa jotta täytettäisiin EU:n matalajännitedirektiivin (Low Voltage Directive) yhteensopivuus. Myös EU:hun kuulumattomien valtioiden tulee nou-dattaa tätä ohjetta, elleivät kansalliset standardit estä sitä.

1. Riittävät maadoituskytkennät on tehtävä kaikkiin maadoituspisteisiin, sisäisiin ja ulkoisiin.
2. Asennuksen ja vianetsinnän jälkeen on kaikki suojat ja suojamaat asennettava takaisin pai-koilleen. Maadoitusliittimen kunnollinen toiminta täytyy aina ylläpitää.
3. Jännitesyöttöjohtimien täytyy täyttää IEC227 ja IEC245 vaatimukset.
4. Kaikkien johdotuksien tulee toimia >75°C lämpötiloissa.
5. Kaikkien läpivientiholkkien sisähalkaisijan täytyy olla sellainen että kaapeli lukkiutuu kun-nolla kiinni.
6. Turvallisen toiminnan varmistamiseksi täytyy jännitesyöttö varustaa turvakytkimellä (min 10A), joka kytkee irti kaikki jännitesyöttöjohtimet vikatilanteessa. Suojaan täytyy myös sisältyä mekaaninen erotuskytkin. Jos ei, niin jännitesyöttö on pystyttävä katkaisemaan muilla keinoilla ja merkittävä siten että se tunnistetaan sellaiseksi. Turvakytkimien tai kat-kaisimien täytyy täyttää IEC947 standardin vaatimukset näkyvyydestä.
7. Mikäli laite tai kosketussuoja on merkitty tällä merkillä on merkinnän takana tai alla hengenvaarallisen suuruinen jännite. Suojaa ei saa poistaa jänniteen ollessa kytkettynä laitteeseen ja poistamisen saa suorittaa vain alan asian-tuntija.

8. Mikäli laite tai kosketussuoja on merkitty tällä merkillä on merkinnän takana tai alla kuuma pinta. Suojan saa poistaa vain alan asiantuntija kun jännite-syöttö on katkaistu. Tällainen pinta voi säilyä kosketuskuumana jopa 45 mi-nuuttia.

9. Mikäli laite tai kosketussuoja on merkitty tällä merkillä katso lisäohjeita käyt-töohjekirjasta.

10. Kaikki tässä tuotteessa käytetyt graafiset symbolit ovat yhdestä tai useammasta seuraavis-ta standardeista: EN61010-1, IEC417 & ISO3864.
11. Jos laitteessa tai tarrassa on merkintä "Älä avaa, kun virta on kytketty" tai vastaava, räjähdysvaarallisissa tiloissa on syttymisen vaara. Nämä laitteet voidaan avata vain silloin, kun virta ei ole kytkettynä ja laitteen on annettu jäähtyä tarrassa tai oppaassa määritetyn ajan. Tällöinkin laitteet saa avata vain koulutettu huoltohenkilökunta.

IMPORTANT

Consignes de sécurité concernant le raccordement et l'installation de cet appareil.

Les consignes de sécurité ci-dessous s'adressent particulièrement à tous les états membres de la communauté européenne. Elles doivent être strictement appliquées afin de satisfaire aux directives concernant la basse tension. Les états non membres de la communauté européenne doivent également appliquer ces consignes sauf si elles sont en contradiction avec les standards locaux ou nationaux.

1. Un raccordement adéquat à la terre doit être effectuée à chaque borne de mise à la terre, interne et externe.
2. Après installation ou dépannage, tous les capots de protection et toutes les prises de terre doivent être remis en place, toutes les prises de terre doivent être respectées en permanence.
3. Les câbles d'alimentation électrique doivent être conformes aux normes IEC227 ou IEC245.
4. Tous les raccordements doivent pouvoir supporter une température ambiante supérieure à 75°C.
5. Tous les presse-étoupes utilisés doivent avoir un diamètre interne en rapport avec les câbles afin d'assurer un serrage correct sur ces derniers.
6. Afin de garantir la sécurité du fonctionnement de cet appareil, le raccordement à l'alimentation électrique doit être réalisé exclusivement au travers d'un disjoncteur (minimum 10A.) isolant tous les conducteurs en cas d'anomalie. Ce disjoncteur doit également pouvoir être actionné manuellement, de façon mécanique. Dans le cas contraire, un autre système doit être mis en place afin de pouvoir isoler l'appareil et doit être signalisé comme tel. Disjoncteurs et interrupteurs doivent être conformes à une norme reconnue telle IEC947.
7. Lorsque les équipements ou les capots affichent le symbole suivant, cela signifie que des tensions dangereuses sont présentes. Ces capots ne doivent être démontés que lorsque l'alimentation est coupée, et uniquement par un personnel compétent.

8. Lorsque les équipements ou les capots affichent le symbole suivant, cela signifie que des surfaces dangereusement chaudes sont présentes. Ces capots ne doivent être démontés que lorsque l'alimentation est coupée, et uniquement par un personnel compétent. Certaines surfaces peuvent rester chaudes jusqu'à 45 mn.

9. Lorsque les équipements ou les capots affichent le symbole suivant, se reporter au manuel d'instructions.

10. Tous les symboles graphiques utilisés dans ce produit sont conformes à un ou plusieurs des standards suivants: EN61010-1, IEC417 & ISO3864.
11. Les équipements comportant une étiquette avec la mention " Ne pas ouvrir sous tension " ou toute autre mention similaire peuvent créer un risque d'incendie dans les environnements explosifs. Ces équipements ne doivent être ouverts que lorsqu'ils sont hors tension et que la durée de refroidissement requise indiquée sur l'étiquette ou dans le manuel d'instructions s'est écoulée. En outre ils ne doivent être ouverts que par un personnel qualifié.

FONTOS

Biztonsági előírások a készülék vezetékeléséhez és üzembeállításához

A következő biztonsági előírások kifejezetten vonatkoznak az összes EU-tagállamra. Ezeket szigorúan be kell tartani a Kisfeszültségű irányelvnek való megfelelés biztosításához. A nem EU-tagállamok szintén tartsák be a következőket, kivéve ha a helyi és nemzeti szabványok azt másként nem írják elő.

1. A megfelelő földelést biztosítani kell az összes rendelkezésre álló földelési ponton, legyen az belső vagy külső.
2. Az üzembeállítás vagy hibaelhárítás után az összes biztonsági burkolatot és biztonsági földvezetéket ki kell cserélni. A földelőkapcsok sértetlenségét mindig biztosítani kell.
3. A tápvezetékeknek eleget kell tenniük az IEC227 vagy IEC245 szabványokban megfogalmazott követelményeknek.
4. Az összes vezetéknek alkalmasnak kell lennie a 75 °C-nál magasabb környezeti hőmérséklet melletti használatra.
5. Az összes használt kábelvezető tömszelencének olyan belső méretűnek kell lennie, hogy biztosítsák a kábelek megfelelő lekötését.
6. A berendezés biztonságos működésének biztosításához az elektromos hálózathoz való csatlakozást csak megszakítón keresztül szabad megvalósítani, amely az összes áramot szállító vezetéket bontja hibahelyzet esetén. A megszakító magában foglalhat egy mechanikusan működtethető áramtalanító kapcsolót is. Ellenkező esetben biztosítani kell a berendezés elektromos hálózatról történő lekapcsolásának más módját, és ezt világosan jelezni kell. A megszakítóknak vagy kapcsolóknak meg kell felelniük egy elismert szabványnak, például az IEC947 szabványnak. Az összes vezetéknek meg kell felelnie az összes helyi szabványnak.
7. Ha a berendezés vagy a burkolata a jobb oldalon látható szimbólummal jelzett, alatta valószínűleg veszélyes feszültség van jelen. Az ilyen burkolat csak a berendezés áramtalanítása után távolítható el - és csak képzett szervizszakember végezheti el.

8. Ha a berendezés vagy a burkolata a jobb oldalon látható szimbólummal jelzett, fenn áll a veszélye, hogy alatta forró felületek találhatóak. Az ilyen burkolatot csak képzett szervizszakember távolíthatja el a berendezés áramtalanítása után. Bizonyos felületek érintésre forróak maradhatnak.

9. Ha a berendezés vagy a burkolata a jobb oldalon látható szimbólummal jelzett, tekintse meg az Üzemeltetési útmutató arra vonatkozó utasításait.

10. A terméken használt grafikus szimbólumok a következő szabványok legalább egyikéből származnak: EN61010-1, IEC417 és ISO3864.
11. Ha a berendezésen vagy a címkéken a „Ne nyissa ki bekapcsolt állapotban” vagy hasonló felhívás szerepel, robbanásveszélyes környezetben fennáll a gyulladás veszélye. Ez a berendezés csak áramtalanítás után nyitható ki, a címkén vagy a kezelési útmutatóban szereplő, a berendezés lehűlését biztosító megfelelő időri ráhagyás után - és csak képzett szervizszakember végezheti el.

IMPORTANTE

Norme di sicurezza per il cablaggio e l'installazione dello strumento.

Le seguenti norme di sicurezza si applicano specificatamente agli stati membri dell'Unione Europea, la cui stretta osservanza è richiesta per garantire conformità alla Direttiva del Basso Voltaggio. Esse si applicano anche agli stati non appartenenti all'Unione Europea, salvo quanto disposto dalle vigenti normative locali o nazionali.

1. Collegamenti di terra idonei devono essere eseguiti per tutti i punti di messa a terra interni ed esterni, dove previsti.
2. Dopo l'installazione o la localizzazione dei guasti, assicurarsi che tutti i coperchi di protezione siano stati collocati e le messa a terra siano collegate. L'integrità di ciscun morsetto di terra deve essere costantemente garantita.
3. I cavi di alimentazione della rete devono essere secondo disposizioni IEC227 o IEC245.
4. L'intero impianto elettrico deve essere adatto per uso in ambiente con temperature superiore a 75°C.
5. Le dimensioni di tutti i connettori dei cavi utilizzati devono essere tali da consentire un adeguato ancoraggio al cavo.
6. Per garantire un sicuro funzionamento dello strumento il collegamento alla rete di alimentazione principale dovrà essere eseguita tramite interruttore automatico (min.10A), in grado di disattivare tutti i conduttori di circuito in caso di guasto. Tale interruttore dovrà inoltre prevedere un sezionatore manuale o altro dispositivo di interruzione dell'alimentazione, chiaramente identificabile. Gli interruttori dovranno essere conformi agli standard riconosciuti, quali IEC947.
7. Il simbolo riportato sullo strumento o sui coperchi di protezione indica probabile presenza di elevati voltaggi. Tali coperchi di protezione devono essere rimossi esclusivamente da personale qualificato, dopo aver tolto alimentazione allo strumento.

8. Il simbolo riportato sullo strumento o sui coperchi di protezione indica rischio di contatto con superfici ad alta temperatura. Tali coperchi di protezione devono essere rimossi esclusivamente da personale qualificato, dopo aver tolto alimentazione allo strumento. Alcune superfici possono mantenere temperature elevate per oltre 45 minuti.

9. Se lo strumento o il coperchio di protezione riportano il simbolo, fare riferimento alle istruzioni del manuale Operatore.

10. Tutti i simboli grafici utilizzati in questo prodotto sono previsti da uno o più dei seguenti standard: EN61010-1, IEC417 e ISO3864.
11. L'indicazione "Non aprire sotto tensione" o simili sull'apparecchiatura o sulle etichette segnala il pericolo di accensione nelle aree in cui è presente un'atmosfera esplosiva. L'apparecchiatura può essere aperta solo quando l'alimentazione è scollegata ed è trascorso il tempo indicato sull'etichetta o nel manuale delle istruzioni per consentirne il raffreddamento. L'operazione può essere effettuata esclusivamente da personale dell'assistenza qualificato.

SVARBU

Šio prietaiso laidų prijungimo ir instaliacijos saugos instrukcijos

Toliau išvardinti saugumo reikalavimai taikomi konkrečiai visoms ES šalims narėms. Jų turi būti griežtai paisoma, kad būtų užtikrintai laikomasi Žemos įtampos direktyvos. Ne ES narės taip pat turi laikytis toliau pateikiamų reikalavimų nebent juos pakeičia vietiniai ar Nacionaliniai standartai.

1. Turi būti atliktas tinkamas įžeminimas visuose įžeminimo taškuose, vidiniuose ir išoriniuose, kur numatyta.
2. Visos apsauginės dangos ir įžemikliai po instaliacijos ar remonto turi būti pakeisti. Visų įžeminimo terminalų vientisumo priežiūra turi būti atliekama nuolat.
3. Matinimo tinklo laidai turi atitikti IEC227 ar IEC245 reikalavimus.
4. Visi laidai turi būti tinkami naudojimui aplinkos temperatūtoje, aukštesnėje nei 75°C.
5. Visi naudojamų kabelių riebokšliai turi būti tokių vidinių matmenų, kad būtų galimas tinkamas kabelio pritvirtinimas.
6. Saugaus šio prietaiso veikimo užtikrinimui, prijungimas prie maitinimo tinklo turi būti atliekamas tik per automatinį pertraukiklį, kuris atjungs visas grandines nešančius konduktorius linijos gedimo metu. Automatinis pertraukiklis taip pat gali turėti mechaniškai veikiantį įzoliavimo jungiklį. Jeigu ne, tuomet turi būti nurodytos kitos įrenginio atjungimo priemonės, ir aiškai pažymėtos, kad jos tokios yra. Automatiniai perjungikliai ar jungikliai turi atitikti pripažintus standartus, tokius kaip IEC947. Visi laidai turi atitikti visus vietinius standartus.
7. Kur įrenginys ar dangos yra pažymėti simboliu dešinėje, žemiau turi būti pavojinga įtampa. Šios dangos turi būti nuimamos tik tada, kai srovė yra pašalinta iš įrenginio - ir tik tuomet tai turi atlikti apmokytas personalas.

8. Ten kur įrenginys ar dangos yra pažymėti simboliu dešinėje, ten yra pavojus nuo karštų paviršių apačioje. Šios dangos gali būti nuimamos tik apmokyto personalo, kai srovė yra pašalinta iš įrenginio. Tam tikri paviršiai gali išlikti karšti liečiant.

9. Ten kur įrenginys ar dangos yra pažymėti simboliu dėšinėje, žr. nurodymus Valdymo instrukcijose.

10. Visi grafiniai simboliai naudojami šiam produktui yra iš vieno ar daugiau toliau išvardintų standartų: EN61010-1, IEC417, ir ISO3864.
11. Ten, kur įrenginys ar etiketės yra pažymėti "Neatidaryti esant srovės tiekimui" ar panašiai, yra užsidegimo pavojus tose vietose, kur yra sprogstamoji atmosfera. Šis įrenginys gali būti atidarytas tuomet, kai yra pašalinta srovė, ir praėjęs atitinkamas laikas, nurodytas etiketėje ar valdymo instrukcijoje, pakankamas įrenginio ataušimui - ir tai tik apmokyto personalo.

SVARĪGI

Drošības norādījumi šīs iekārtas pievienošanai un uzstādīšanai

Turpmākie drošības norādījumi attiecas uz visām ES dalībvalstīm. Tie ir stingri jāievēro, lai nodrošinātu atbilstību Zemsprieguma direktīvai. Turpmāk norādītais jāievēro arī valstīs, kas nav ES dalībvalstis, ja vien šos norādījumus neaizstāj vietējie vai valsts standarti.

1. Visi pieejamie iekšējie un ārējie zemējuma punkti ir atbilstoši jāiezemē.
2. Pēc uzstādīšanas vai problēmu risināšanas visi drošības pārsegi un drošības zemējuma savienojumi ir jāpievieno atpakaļ. Visiem zemējuma savienojumiem vienmēr jābūt iezemētiem.
3. Elektropadeves vadiem jāatbilst IEC227 vai IEC245 prasībām.
4. Visai elektroinstalācijai jābūt piemērotai lietošanai apkārtējā temperatūrā, kas pārsniedz 75°C.
5. Visu izmantoto kabeļu blīvju iekšējiem izmēriem jābūt tādiem, lai atbilstoši nostiprinātu kabeli.
6. Lai nodrošinātu šīs iekārtas drošu darbību, savienojums ar elektropadeves tīklu jāizveido, izmantojot slēdzi, kas kļūmes gadījumā atvienos visas ķēdes, kurās ir vadītāji. Slēdzī var būt iestrādāts arī mehānisks pārtraucējslēdzis. Ja tāda nav, tad ir jāuzstāda cita veida ierīce iekārtas atvienošanai no strāvas padeves un tā atbilstoši un skaidri jāmarķē. Slēdžiem jāatbilst kādam vispāratzītam standartam, piemēram, IEC947. Visai elektroinstalācijai jāatbilst vietējiem standartiem.
7. Vietās, kur iekārta vai tās pārsegi ir marķēti ar labajā pusē norādīto simbolu, visticamāk, zem tiem ir bīstams spriegums. Šos pārsegus drīkst noņemt tikai tad, ja iekārta ir atvienota no strāvas padeves, – un šos darbus drīkst veikt tikai atbilstoši apmācīti remontdarbu darbinieki.

8. Vietās, kur iekārta vai tās pārsegi ir marķēti ar labajā pusē norādīto simbolu, apdraudējumu izraisa zem tiem esošās karstās virsmas. Šos pārsegus drīkst noņemt tikai atbilstoši apmācīti remontdarbu darbinieki, kad iekārta ir atvienota no strāvas padeves. Iespējams, dažas virsmas arī pēc iekārtas atvienošanas paliks karstas.

9. Ja iekārta vai pārsegi ir marķēti ar labajā pusē esošo simbolu, skatiet operatora rokasgrāmatā ietvertos norādījumus.

10. Visi šajā izstrādājumā izmantotie grafiskie simboli atbilst vienam vai vairākiem no šiem standartiem: EN61010-1, IEC417 un ISO3864.
11. Ja iekārtai vai uzlīmēm ir marķējums "Neatvērt, kamēr pieslēgta strāvai" vai tamlīdzīga norāde, tas nozīmē, ka sprādzienbīstamā vidē ir uzliesmošanas bīstamība. Šo iekārtu drīkst atvērt tikai tad, ja ir atvienota strāva un ir nogaidīts iekārtas atdzišanai nepieciešamais laiks, kas norādīts uzlīmē vai ekspluatācijas rokasgrāmatā, – un šos darbus drīkst veikt tikai atbilstoši apmācīti remontdarbu darbinieki.

IMPORTANTI

STRUZZJONIJIET TAS-SIGURTÀ GĦALL-WIRING U L-INSTALLAZZJONI TAT-TAGĦMIR

L-istruzzjonijiet tas-sigurtà japplikaw speċifikament għall-Istati Membri ta' l-UE. Dawn għandhom jiġu osservati b'mod strett biex tkun żgurata l-konformità mad-Direttiva dwar il-Vultaġġ Baxx. Stati li mhumiex membri ta' l-UE għandhom ukoll ikunu konformi ma' dan li ġej ħlief jekk dawn ikunu sostituti mill-Istandards lokali jew Nazzjonali.

1. Konnessjonijiet adegwati ta' l-ert għandhom isiru għall-punti kollha ta' l-ert, interni u esterni, fejn ikun ipprovdut.
2. Wara l-installazzjoni jew meta tipprova ssolvi xi problema, l-għatjien kollha tas-sigurtà u l-erts tas-sigurtà għandhom jitpoġġew lura f'posthom. L-integrità tat-terminali kollha ta' l-ert għandha tinżamm f'kull ħin.
3. Il-wajers tal-provvista tad-dawl għandhom ikunu konformi ml-ħtiġijiet ta' IEC227 jew IEC245.
4. Il-*wiring* kollu għandu jkun adattat għall-użu f'temperatura ta' l-ambjent ta' iktar minn 75°C.
5. Il-*glands* tal-kejbils kollha li jintużw iridu jkunu ta' daqs intern tali li jipprovdu ankoraġġ adegwat lill-kejbil.
6. Biex tiżgura t-tħaddim sigur ta' dan it-tagħmir, il-konnessjoni mal-provvista tad-dawl għandha ssir biss permezz ta' *circuit breaker* li jiskonnetta l-kondutturi kollha li jkunu jġorru ċ-ċirkuwiti f'sitwazzjoni meta jkun hemm il-ħsara. Is-*circuit breaker* jista wkoll jinkludi swiċċ li jiżola li jaħdem b'mod mekkaniku. Jekk dan ma jkunx il-każ, mezz ieħor ta' kif it-tagħmir jiġi skonnettjat minn mal-provvista tad-dawl għandu jkun ipprovdut, u jkun immrkat b'mod ċar li hu hekk. Is-*circuit breakers* jew swiċċijiet iridu jkunu konformi ma' standard rikonoxxut bħal IEC947. Il-*wiring* kollu jrid ikun konformi ma' l-istandards lokali, jekk ikun hemm.
7. Meta t-tagħmir jew l-għatjien ikunu mmarkati bis-simbolu fuq il-lemin, x'aktarx li jkun hemm vultaġġi perikoluži taħthom. Dawn l-għatjien għandhom jitneħħew biss meta titneħħa l-provvista tad-dawl mit-tagħmir - u minn ħaddiema tal-manutenzjoni mħarrġa biss.

8. Meta t-tagħmir jew l-għatjien ikunu mmarkati bis-simbolu fuq il-lemin, ikun hemm periklu mill-uċuħ jaħarqu li jkun hemm taħthom. Dawn l-għatjien għandhom jitneħħew biss minn ħaddiema tal-manutenzjoni mħarrġa meta titneħħa l-provvista tad-dawl mit-tagħmir. Ċerti wċuħ jistgħu jibqgħu jaħarqu meta tmisshom.

9. Meta t-tagħmir jew l-għatjien ikunu mmarkati bis-simbolu fuq il-lemin, irreferi għall-Manwal ta' l-Operatur għall-istruzzjonijiet.
10. Is-simboli grafiċi kollha użati f'dan il-prodott huma minn wieħed jew iktar mill-istandards li ġejjin: EN61010-1, IEC417, u ISO3864.

11. Fejn it-tagħmir u t-tikketti huma mmarkati bil-kliem “Tiftaħx Meta Jkun Enerġizzat” jew kliem simili, hemm periklu ta' nar f'żoni fejn atmosfera esplossiva hi preżenti. It-tagħmir għandu jinfetaħ biss meta l-provvista tad-dawl tkun mitfija u jkun għadda ħin biżżejjed, kif speċifikat fuq it-tikketta jew fil-manwal ta' l-istruzzjonijiet, biex it-tagħmir ikun kesaħ – u t-tagħmir għandu jinfetaħ biss minn staff li jkun imħarreġ.

VIKTIG

Sikkerhetsinstruks for tilkobling og installasjon av dette utstyret.

Følgende sikkerhetsinstruksjoner gjelder spesifikt alle EU medlemsland og land med i EØS-avtalen. Instruksjonene skal følges nøye slik at installasjonen blir i henhold til lavspenningsdirektivet. Den bør også følges i andre land, med mindre annet er spesifisert av lokale- eller nasjonale standarder.

1. Passende jordforbindelser må tilkobles alle jordingspunkter, interne og eksterne hvor disse forefinnes.
2. Etter installasjon eller feilsøking skal alle sikkerhetsdeksler og jordforbindelser reetableres. Jordingsforbindelsene må alltid holdes i god stand.
3. Kabler fra spenningsforsyning skal oppfylle kravene spesifisert i IEC227 eller IEC245.
4. Alle ledningsforbindelser skal være konstruert for en omgivelsestemperatur høyere en 75°C.
5. Alle kabelforskruvninger som benyttes skal ha en indre dimensjon slik at tilstrekkelig avlastning oppnåes.
6. For å oppnå sikker drift og betjening skal forbindelsen til spenningsforsyningen bare skje gjennom en strømbryter (minimum 10A) som vil bryte spenningsforsyningen til alle elektriske kretser ved en feilsituasjon. Strømbryteren kan også inneholde en mekanisk operert bryter for å isolere instrumentet fra spenningsforsyningen. Dersom det ikke er en mekanisk operert bryter installert, må det være en annen måte å isolere utstyret fra spenningsforsyningen, og denne måten må være tydelig merket. Kretsbrytere eller kontakter skal oppfylle kravene i en annerkjent standard av typen IEC947 eller tilsvarende.
7. Der hvor utstyr eller deksler er merket med symbol for farlig spenning, er det sannsynlig at disse er tilstede bak dekslet. Disse dekslene må bare fjærnes når spenningsforsyning er frakoblet utstyret, og da bare av trenet servicepersonell.

8. Der hvor utstyr eller deksler er merket med symbol for meget varm overflate, er det sannsynlig at disse er tilstede bak dekslet. Disse dekslene må bare fjærnes når spenningsforsyning er frakoblet utstyret, og da bare av trenet servicepersonell. Noen overflater kan være for varme til å berøres i opp til 45 minutter etter spenningsforsyning frakoblet.

9. Der hvor utstyret eller deksler er merket med symbol, vennligst referer til instruksjonsmanualen for instrukser.

10. Alle grafiske symboler brukt i dette produktet er fra en eller flere av følgende standarder: EN61010-1, IEC417 & ISO3864.
11. Når utstyr eller merkelapper bærer advarselen "Må ikke åpnes under spenning" eller lignende, innbærer det fare for eksplosjon i områder med en eksplosiv atmosfære. Utstyret skal bare åpnes når det ikke er noen strømtilførsel, og etter at det har hatt tilstrekkelig tid til å kjøle ned, som spesifisert på merkelappen eller i håndboken. Selv da skal utstyret bare åpnes av erfarne serviceteknikere.

WAŻNE!

Zalecenia dotyczące bezpieczeństwa w zakresie podłączania i instalacji tego urządzenia

Następujące zalecenia dotyczą zwłaszcza stosowania urządzenia we wszystkich krajach Unii Europejskiej. Należy się ściśle do nich stosować w celu zapewnienia zgodności z dyrektywą niskonapięciową. W przypadku instalacji urządzenia w krajach nienależących do Unii Europejskiej należy również przestrzegać poniższych zaleceń, chyba że są one zastąpione lokalnymi lub ogólnokrajowymi standardami.

1. Urządzenie należy podłączyć kablem uziemiającym do wszystkich punktów uziemienia (wewnętrznych i zewnętrznych).
2. Po instalacji lub czynnościach serwisowych należy zamknąć wszystkie pokrywy zabezpieczające i ponownie podłączyć uziemienie. Należy pilnować, by nie doszło do przerwania uziemienia.
3. Przewody zasilające powinny być zgodne z wymaganiami normy IEC227 lub IEC245.
4. Wszystkie przewody powinny być odpowiednie do użytku w środowisku o temperaturze wyższej niż 75°C.
5. Wszystkie dławnice powinny mieć wymiary wewnętrzne zapewniające pewne umocowanie przewodów.
6. W celu zapewnienia bezpiecznej pracy urządzenie należy podłączyć do sieci tylko za pośrednictwem wyłącznika automatycznego, który w razie awarii odłączy wszystkie obwody, w których przepływa prąd. Wyłącznik automatyczny może być również wyposażony w mechaniczny odłącznik napięcia. W przeciwnym razie należy zapewnić i jasno oznaczyć inną możliwość odłączenia urządzenia od zasilania. Wyłączniki automatyczne oraz odłączniki powinny być zgodne z uznawanymi standardami, takimi jak norma IEC947. Wszystkie przewody muszą być zgodne z lokalnymi przepisami.
7. Pod pokrywami lub elementami urządzenia oznaczonymi symbolem pokazanym na rysunku po prawej stronie może występować niebezpieczne napięcie elektryczne. Te pokrywy mogą być zdejmowane tylko po odłączeniu zasilania, wyłącznie przez odpowiednio przeszkolonych pracowników serwisu.

8. Pod pokrywami lub elementami urządzenia oznaczonymi symbolem pokazanym na rysunku po prawej stronie znajdują się gorące powierzchnie. Te pokrywy mogą być zdejmowane tylko po odłączeniu zasilania, wyłącznie przez odpowiednio przeszkolonych pracowników serwisu. Niektóre powierzchnie mogą pozostać nagrzane przez pewien czas po odłączeniu zasilania.

9. W przypadku sprzętu oraz pokryw oznaczonych symbolem pokazanym na rysunku po prawej stronie należy zapoznać się ze wskazówkami w Instrukcji operatora i stosować się do nich.

10. Wszystkie symbole graficzne zastosowane do oznaczenia produktu pochodzą z następujących norm: EN61010-1, IEC417 lub ISO3864.
11. Oznaczenie „Nie otwierać, gdy urządzenie jest pod napięciem” lub podobne oznaczenia informują o ryzyku zapłonu w miejscach, gdzie występuje zagrożenie wybuchem. Urządzenie należy otwierać tylko po odłączeniu zasilania i po upływie czasu na ostygnięcie urządzenia oznaczonego na etykiecie lub w instrukcji obsługi. Urządzenie mogą otwierać wyłącznie odpowiednio przeszkoleni pracownicy serwisu.

IMPORTANTE

Instruções de segurança para ligação e instalação deste aparelho.

As seguintes instruções de segurança aplicam-se especificamente a todos os estados membros da UE. Devem ser observadas rigidamente por forma a garantir o cumprimento da Directiva sobre Baixa Tensão. Relativamente aos estados que não pertençam à UE, deverão cumprir igualmente a referida directiva, exceptuando os casos em que a legislação local a tiver substituído.

1. Devem ser feitas ligações de terra apropriadas a todos os pontos de terra, internos ou externos.
2. Após a instalação ou eventual reparação, devem ser recolocadas todas as tampas de segurança e terras de protecção. Deve manter-se sempre a integridade de todos os terminais de terra.
3. Os cabos de alimentação eléctrica devem obedecer às exigências das normas IEC227 ou IEC245.
4. Os cabos e fios utilizados nas ligações eléctricas devem ser adequados para utilização a uma temperatura ambiente até 75ºC.
5. As dimensões internas dos bucins dos cabos devem ser adequadas a uma boa fixação dos cabos.
6. Para assegurar um funcionamento seguro deste equipamento, a ligação ao cabo de alimentação eléctrica deve ser feita através de um disjuntor (min. 10A) que desligará todos os condutores de circuitos durante uma avaria. O disjuntor poderá também conter um interruptor de isolamento accionado manualmente. Caso contrário, deverá ser instalado qualquer outro meio para desligar o equipamento da energia eléctrica, devendo ser assinalado convenientemente. Os disjuntores ou interruptores devem obedecer a uma norma reconhecida, tipo IEC947.
7. Sempre que o equipamento ou as tampas contiverem o símbolo, é provável a existência de tensões perigosas. Estas tampas só devem ser retiradas quando a energia eléctrica tiver sido desligada e por Pessoal da Assistência devidamente treinado.

8. Sempre que o equipamento ou as tampas contiverem o símbolo, há perigo de existência de superfícies quentes. Estas tampas só devem ser retiradas por Pessoal da Assistência devidamente treinado e depois de a energia eléctrica ter sido desligada. Algumas superfícies permanecem quentes até 45 minutos depois.

9. Sempre que o equipamento ou as tampas contiverem o símbolo, o Manual de Funcionamento deve ser consultado para obtenção das necessárias instruções.

10. Todos os símbolos gráficos utilizados neste produto baseiam-se em uma ou mais das seguintes normas: EN61010-1, IEC417 e ISO3864.
11. Sempre que o equipamento ou as etiquetas apresentarem o aviso "Não abrir quando ligado à corrente" ou semelhante, existe um risco de ignição em atmosferas explosivas. Este equipamento só deve ser aberto depois de desligado da corrente eléctrica e o tempo de arrefecimento adequado especificado na etiqueta ou no manual de instruções ter decorrido. O equipamento só pode ser aberto por técnicos qualificados.

DÔLEŽITÉ

Bezpečnostné pokyny pre zapojenie káblov a inštaláciu tohto prístroja

Nasledovné bezpečnostné pokyny sa vzt'ahujú konkrétne na všetky členské štáty EÚ. Musia byt' striktne dodržané, aby sa zaistila zhoda so Smernicou o nízkom napätí. Štáty, ktoré nie sú členskými štátmi EÚ by mali nasledovné pokyny taktiež dodržiavat', pokiaľ nie sú nahradené miestnymi alebo národnými normami.

1. Adekvátne uzemnenia musia byt' vykonané na všetkých bodoch uzemnenia, interných aj externých, tam, kde sú poskytnuté.
2. Po inštalácii alebo riešení problémov musia byt' všetky bezpečnostné kryty a bezpečnostné uzemnenia vymenené. Integrita všetkých uzemňovacích terminálov musí byt' vždy zachovaná.
3. Káble sieťového napájania musia byt' v zhode s požiadavkami IEC227 alebo IEC245.
4. Všetky káblové pripojenia by mali byt' vhodné pre používanie v teplote okolia vyššej, ako 75°C.
5. Všetky použité káblové priechodky musia mat' také vnútorné rozmery, aby poskytovali adekvátne uchopenie kábla.
6. Pre zaistenie bezpečnej prevádzky tohto zariadenia musí byt' pripojenie k sieťovému napájaniu zapojené len cez prerušovač obvodu, ktorý počas poruchovej situácie odpojí všetky obvody elektrických vodičov. Prerušovač obvodu by mal obsahovat' aj mechanicky ovládaný úsekový vypínač. Ak nie, musí byt' poskytnutý iný spôsob odpojenia zariadenia od sieťového napájania a tento spôsob musí byt' zreteľne označený. Prerušovače obvodu alebo spínače musia byt' v zhode s uznanou normou, ako napr. IEC947. Všetky káblové pripojenia musia vyhovovat' akýmkoľvek miestnym normám.
7. Tam, kde je zariadenie alebo kryty označené symbolom na pravej strane, sa pravdepodobne nachádza nebezpečné napätie. Tieto kryty by sa mali odoberat' len vtedy, keď je zariadenie odpojené od elektrickej energie a len vyškoleným servisným personálom.

8. Tam, kde je zariadenie alebo kryty označené symbolom na pravej strane, existuje nebezpečenstvo horúcich povrchov. Tieto kryty by mali byt' odstraňované len vyškoleným servisným personálom, pričom je zariadenie odpojené od elektrickej energie. Určité povrchy môžu ostat' horúce na dotyk.

9. V miestach, kde je zariadenie alebo kryty označené symbolom na pravej strane, si kvôli pokynom pozrite Operátorskú príručku.

10. Všetky obrázkové symboly použité pri tomto produkte zodpovedajú jednej alebo viacerým nasledujúcim normám: EN61010-1, IEC417 a ISO3864.
11. V miestach, kde je zariadenie alebo značky označené nápisom "Neotvárat' pod elektrickým prúdom" alebo podobné, existuje nebezpečenstvo vznietenia v oblastiach s prítomnost'ou výbušného ovzdušia. Toto zariadenie sa smie otvárat' len v prípade odpojenia od elektrického napájania a ponechania zariadenia vychladnút' po dobu uplynutia dostatočného času tak, ako je to uvedené na štítku alebo v návode na použitie - a len vyškoleným servisným personálom.

POMEMBNO

Varnostna navodila za povezavo in vgradnjo naprave

Naslednja varnostna navodila veljajo za vse države članice EU. Zaradi zagotovitve skladnosti z nizkonapetostno direktivo morate navodila strogo upoštevati. V državah, ki niso članice EU, je treba upoštevati tudi naslednje smernice, razen če jih ne zamenjujejo lokalni ali nacionalnimi standardi.

1. Do vseh ozemljitvenih točk, notranjih in zunanjih, ki so na voljo, morajo biti speljane ustrezne ozemljitvene povezave.
2. Po vgradnji ali odpravljanju težav je treba namestiti vse varnostne pokrove in zaščitne ozemljitve. Brezhibnost vseh ozemljitvenih priključkov je treba nenehno preverjati.
3. Omrežni napajalni kabli morajo biti skladni z zahtevami standarda IEC227 ali IEC245.
4. Vsa napeljava mora biti primerna za uporabi pri temperaturi okolja, višji od 75 °C.
5. Notranje dimenzije kabelskih tesnilk morajo zagotavljati ustrezno pritrditev kablov.
6. Za zagotovitev varnega delovanja opreme mora biti povezava z omrežnim napajanjem vzpostavljena prek odklopnega stikala, ki v primeru napake izklopi vse tokokroge s prevodniki. Odklopno stikalo lahko vključuje tudi mehansko izolacijsko stikalo. V nasprotnem primeru morajo biti zagotovljeni in jasno označeni drugi načini za izklop opreme iz napajanja. Odklopna in druga stikala morajo biti skladna z uveljavljenimi standardi, kot je IEC947. Vsa napeljava mora biti skladna z lokalnimi standardi.
7. V opremi ali pod pokrovi, ki so označeni s simbolom na desni, je prisotna nevarna napetost. Te pokrove je dovoljeno odstraniti samo, če je napajanje opreme izklopljeno. To lahko izvaja samo usposobljeno servisno osebje.

8. Pri opremi ali pod pokrovi, ki so označeni s simbolom na desni, so prisotne nevarne vroče površine. Te pokrove lahko odstranjuje samo usposobljeno servisno osebje. Napajanje opreme mora biti izklopljeno. Določene površine so lahko vroče.

9. Pri opremi ali pokrovih, ki so označeni s simbolom na desni, si za navodila oglejte priročnik za upravljanje.

10. Vsi uporabljeni grafični simboli so iz enega ali več naslednjih standardov: EN61010-1, IEC417 in ISO3864.
11. Če je na opremi ali oznakah navedeno "Ne odpirajte, če je pod napetostjo" ali podobno opozorilo, je na območjih z eksplozivnim ozračjem prisotna nevarnost vžiga. To opremo je dovoljeno odpirati samo, če je napajanje izklopljeno in je poteklo dovolj časa, da se oprema ohladi, kot je navedeno na oznaki ali v priročniku z navodili. Opremo lahko odpira samo usposobljeno servisno osebje.

IMPORTANTE

Instrucciones de seguridad para el montaje y cableado de este aparato.

Las siguientes instrucciones de seguridad, son de aplicacion especifica a todos los miembros de la UE y se adjuntaran para cumplir la normativa europea de baja tension.

1. Se deben preveer conexiones a tierra del equipo, tanto externa como internamente, en aquellos terminales previstos al efecto.
2. Una vez finalizada las operaciones de mantenimiento del equipo, se deben volver a colocar las cubiertas de seguridad aasi como los terminales de tierra. Se debe comprobar la integridad de cada terminal.
3. Los cables de alimentacion electrica cumpliran con las normas IEC 227 o IEC 245.
4. Todo el cableado sera adecuado para una temperatura ambiental de 75ºC.
5. Todos los prensaestopas seran adecuados para una fijacion adecuada de los cables.
6. Para un manejo seguro del equipo, la alimentacion electrica se realizara a traves de un interruptor magnetotermico (min 10 A), el cual desconectara la alimentacion electrica al equipo en todas sus fases durante un fallo. Los interruptores estaran de acuerdo a la norma IEC 947 u otra de reconocido prestigio.
7. Cuando las tapas o el equipo lleve impreso el simbolo de tension electrica peligrosa, dicho alojamiento solamente se abrira una vez que se haya interrumpido la alimentacion electrica al equipo asimismo la intervencion sera llevada a cabo por personal entrenado para estas labores.

8. Cuando las tapas o el equipo lleve impreso el simbolo, hay superficies con alta temperatura, por tanto se abrira una vez que se haya interrumpido la alimentacion electrica al equipo por personal entrenado para estas labores, y al menos se esperara unos 45 minutos para enfriar las superficies calientes.

9. Cuando el equipo o la tapa lleve impreso el simbolo, se consultara el manual de instrucciones.

10. Todos los simbolos graficos usados en esta hoja, estan de acuerdo a las siguientes normas EN61010-1, IEC417 & ISO 3864.
11. Cuando el equipo o las etiquetas tienen la indicación " No abrir mientras reciba energía" u otra similar, existe el peligro de ignición en zonas donde haya un ambiente explosivo. Este equipo sólo debe ser abierto por personal de servicio cualificado después de apagarlo y dejar pasar el intervalo de tiempo correspondiente indicado en la etiqueta o el manual de instrucciones para que el equipo se enfríe.

VIKTIGT

Säkerhetsföreskrifter för kablage och installation av denna apparat.

Följande säkerhetsföreskrifter är tillämpliga för samtliga EU-medlemsländer. De skall följas i varje avseende för att överensstämma med Lågspännings direktivet. Icke EU medlemsländer skall också följa nedanstående punkter, såvida de inte övergrips av lokala eller nationella föreskrifter.

1. Tillämplig jordkontakt skall utföras till alla jordade punkter, såväl internt som externt där så erfordras.
2. Efter installation eller felsökning skall samtliga säkerhetshöljen och säkerhetsjord återplaceras. Samtliga jordterminaler måste hållas obrutna hela tiden.
3. Matningsspänningens kabel måste överensstämma med föreskrifterna i IEC227 eller IEC245.
4. Allt kablage skall vara lämpligt för användning i en omgivningstemperatur högre än 75ºC.
5. Alla kabelförskruvningar som används skall ha inre dimensioner som motsvarar adekvat kabelförankring.
6. För att säkerställa säker drift av denna utrustning skall anslutning till huvudströmmen endast göras genom en säkring (min 10A) som skall frånkoppla alla strömförande kretsar när något fel uppstår. Säkringen kan även ha en mekanisk frånskiljare. Om så inte är fallet, måste ett annat förfarande för att frånskilja utrustningen från strömförsörjning tillhandahållas och klart framgå genom markering. Säkring eller omkopplare måste överensstämma med en gällande standard såsom t ex IEC947.
7. Där utrustning eller hölje är markerad med vidstående symbol föreliggerisk för livsfarlig spänning i närheten. Dessa höljen får endast avlägsnas när strömmen ej är ansluten till utrustningen - och då endast av utbildad servicepersonal.

8. När utrustning eller hölje är markerad med vidstående symbol föreligger risk för brännskada vid kontakt med uppvärmd yta. Dessa höljen får endast avlägsnas av utbildad servicepersonal, när strömmen kopplats från utrustningen. Vissa ytor kan vara mycket varma att vidröra även upp till 45 minuter efter avstängning av strömmen.

9. När utrustning eller hölje markerats med vidstående symbol bör instruktionsmanualen studeras för information.

10. Samtliga grafiska symboler som förekommer i denna produkt finns angivna i en eller flera av följande föreskrifter:- EN61010-1, IEC417 & ISO3864.
11. För utrustning som markerats med föreskrifter som "Öppna inte när strömmen är på", eller liknande, råder explosionsrisk när det förekommer explosiva ångor. Utrustningen får endast öppnas efter att strömmen stängts av och efter att utrustningen fått svalna under så lång tid som anges i instruktionsboken. Öppnandet får endast utföras av utbildad servicepersonal.

SAFETY DATA SHEET FOR CERAMIC FIBER PRODUCTS

JULY 1, 1996

SECTION I. IDENTIFICATION

PRODUCT NAME
Ceramic Fiber Heaters, Molded Insulation Modules and Ceramic Fiber Radiant Heater Panels.

CHEMICAL FAMILY
Vitreous Aluminosilicate Fibers with Silicon Dioxide.

CHEMICAL NAME
N.A.

CHEMICAL FORMULA
N.A.

MANUFACTURER'S NAME AND ADDRESS

Watlow Columbia
2101 Pennsylvania Drive
Columbia, MO 65202
573-814-1300, ext. 5170
573-474-9402

HEALTH HAZARD SUMMARY WARNING

- Possible cancer hazard based on tests with laboratory animals.
- May be irritating to skin, eyes and respiratory tract.
- May be harmful if inhaled.
- Cristobalite (crystalline silica) formed at high temperatures (above 1800ºF) can cause severe respiratory disease.

SECTION II. PHYSICAL DATA

APPEARANCE AND ODOR
Cream to white colored fiber shapes. With or without optional white to gray granular surface coating and/or optional black surface coating.

SPECIFIC WEIGHT: 12-25 LB./CUBIC FOOT

BOILING POINT: N.A.

VOLATILES (% BY WT.): N.A.

WATER SOLUBILITY: N.A.

SECTION III. HAZARDOUS INGREDIENTS

MATERIAL, QUANTITY, AND THRESHOLD/EXPOSURE LIMIT VALUES

Aluminosilicate (vitreous) 99+ %	1 fiber/cc TWA
CAS. No. 142844-00-06	10 fibers/cc CL
Zirconium Silicate	0-10% 5 mg/cubic meter (TLV)
Black Surface Coating**	0 - 1% 5 mg/cubic meter (TLV)
Armorphous Silica/Silicon Dioxide	0-10% 20 mppcf (6 mg/cubic meter) PEL (OSHA 1978) 3 gm cubic meter (Respirable dust): 10 mg/cubic meter, Intended TLV (ACGIH 1984-85)

**Composition is a trade secret.

SECTION IV. FIRE AND EXPLOSION DATA

FLASH POINT: None

FLAMMABILITY LIMITS: N.A.

EXTINGUISHING MEDIA
Use extinguishing agent suitable for type of surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS / SPECIAL FIRE FIGHTING PROCEDURES
N.A.

SECTION V. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE
(See Section III)

EFFECTS OF OVER EXPOSURE

- EYE - Avoid contact with eyes. Slightly to moderately irritating. Abrasive action may cause damage to outer surface of eye.
- INHALATION - May cause respiratory tract irritation. Repeated or prolonged breathing of particles of respirable size may cause inflammation of the lung leading to chest pain, difficult breathing, coughing and possible fibrotic change in the lung (Pneumoconiosis). Pre-existing medical conditions may be aggravated by exposure: specifically, bronchial hyper-reactivity and chronic bronchial or lung disease.
- INGESTION - May cause gastrointestinal disturbances. Symptoms may include irritation and nausea, vomiting and diarrhea.
- SKIN - Slightly to moderate irritating. May cause irritation and inflammation due to mechanical reaction to sharp, broken ends of fibers.

EXPOSURE TO USED CERAMIC FIBER PRODUCT

Product which has been in service at elevated temperatures (greater than 1800ºF/982ºC) may undergo partial conversion to cristobalite, a form of crystalline silica which can cause severe respiratory disease (Pneumoconiosis). The amount of cristobalite present will depend on the temperature and length of time in service. (See Section IX for permissible exposure levels).

SPECIAL TOXIC EFFECTS

The existing toxicology and epidemiology data bases for RCF's are still preliminary. Information will be updated as studies are completed and reviewed. The following is a review of the results to date:

EPIDEMIOLOGY

At this time there are no known published reports demonstrating negative health outcomes of workers exposed to refractory ceramic fiber (RCF). Epidemiologic investigations of RCF production workers are ongoing.

1. There is no evidence of any fibrotic lung disease (interstitial fibrosis) whatsoever on x-ray.
2. There is no evidence of any lung disease among those employees exposed to RCF that had never smoked.

3. A statistical "trend" was observed in the exposed population between the duration of exposure to RCF and a decrease in some measures of pulmonary function. These observations are clinically insignificant. In other words, if these observations were made on an individual employee, the results would be interpreted as being within the normal range.
4. Pleural plaques (thickening along the chest wall) have been observed in a small number of employees who had a long duration of employment. There are several occupational and non-occupational causes for pleural plaque. It should be noted that plaques are not "pre-cancer" nor are they associated with any measurable effect on lung function.

TOXICOLOGY

A number of studies on the health effects of inhalation exposure of rats and hamsters are available. Rats were exposed to RCF in a series of life-time nose-only inhalation studies. The animals were exposed to 30, 16, 9, and 3 mg/m3, which corresponds with approximately 200, 150, 75, and 25 fibers/cc.

Animals exposed to 30 and 16 mg/m3 were observed to have developed a pleural and parenchymal fibroses; animals exposed to 9 mg/m3 had developed a mild parenchymal fibrosis; animals exposed to the lowest dose were found to have the response typically observed any time a material is inhaled into the deep lung. While a statistically significant increase in lung tumors was observed following exposure to the highest dose, there was no excess lung cancers at the other doses. Two rats exposed to 30 mg/m3 and one rat exposed to 9 mg/m3 developed masotheliomas.

The International Agency for Research on Cancer (IARC) reviewed the carcinogenicity data on man-made vitreous fibers (including ceramic fiber, glasswool, rockwool, and slagwool) in 1987. IARC classified ceramic fiber, fibrous glasswool and mineral wool (rockwool and slagwool) as possible human carcinogens (Group 2B).

EMERGENCY FIRST AID PROCEDURES

- EYE CONTACT - Flush eyes immediately with large amounts of water for approximately 15 minutes. Eye lids should be held away from the eyeball to insure thorough rinsing. Do not rub eyes. Get medical attention if irritation persists.
- INHALATION - Remove person from source of exposure and move to fresh air. Some people may be sensitive to fiber induced irritation of the respiratory tract. If symptoms such as shortness of breath, coughing, wheezing or chest pain develop, seek medical attention. If person experiences continued breathing difficulties, administer oxygen until medical assistance can be rendered.
- INGESTION - Do not induce vomiting. Get medical attention if irritation persists.
- SKIN CONTACT - Do not rub or scratch exposed skin. Wash area of contact thoroughly with soap and water. Using a skin cream or lotion after washing may be helpful. Get medical attention if irritation persists.

SECTION VI. REACTIVITY DATA

STABILITY/CONDITIONS TO AVOID
Stable under normal conditions of use.

HAZARDOUS POLYMERIZATION/CONDITIONS TO AVOID
N.A.

INCOMPATIBILITY/MATERIALS TO AVOID
Incompatible with hydrofluoric acid and concentrated alkali.

HAZARDOUS DECOMPOSITION PRODUCTS
N.A.

SECTION VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
Where possible, use vacuum suction with HEPA filters to clean up spilled material. Use dust suppressant where sweeping if necessary. Avoid clean up procedure which may result in water pollution. (Observe Special Protection Information Section VIII.)

WASTE DISPOSAL METHODS

The transportation, treatment, and disposal of this waste material must be conducted in compliance with all applicable Federal, State, and Local regulations.

SECTION VIII. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION
Use NIOSH or MSHA approved equipment when airborne exposure limits may be exceeded. NIOSH/MSHA approved breathing equipment may be required for non-routine and emergency use. (See Section IX for suitable equipment).

Pending the results of long term health effects studies, engineering control of airborne fibers to the lowest levels attainable is advised.

VENTILATION
Ventilation should be used whenever possible to control or reduce airborne concentrations of fiber and dust. Carbon monoxide, carbon dioxide, oxides of nitrogen, reactive hydrocarbons and a small amount of formaldehyde may accompany binder burn off during first heat. Use adequate ventilation or other precautions to eliminate vapors resulting from binder burn off. Exposure to burn off fumes may cause respiratory tract irritation, bronchial hyper-reactivity and asthmatic response.

SKIN PROTECTION
Wear gloves, hats and full body clothing to prevent skin contact. Use separate lockers for work clothes to prevent fiber transfer to street clothes. Wash work clothes separately from other clothing and rinse washing machine thoroughly after use.

EYE PROTECTION
Wear safety glasses or chemical worker's goggles to prevent eye contact. Do not wear contact lenses when working with this substance. Have eye baths readily available where eye contact can occur.

SECTION IX. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

General cleanliness should be followed.

The Toxicology data indicate that ceramic fiber should be handled with caution. The handling practices described in this MSDS must be strictly followed. In particular, when handling refractory ceramic fiber in any application, special caution should be taken to avoid unnecessary cutting and tearing of the material to minimize generation of airborne dust.

It is recommended that full body clothing be worn to reduce the potential for skin irritation. Washable or disposable clothing may be used. Do not take unwashed work clothing home. Work clothes should be washed separately from other clothing. Rinse washing machine thoroughly after use. If clothing is to be laundered by someone else, inform launderer of proper procedure. Work clothes and street clothes should be kept separate to prevent contamination.

Product which has been in service at elevated temperatures (greater than 1800°F/982°C) may undergo partial conversion to cristobalite, a form of crystalline silica. This reaction occurs at the furnace lining hot face. As a consequence, this material becomes more friable; special caution must be taken to minimize generation of air-borne dust. The amount of cristobalite present will depend on the temperature and length in service.

IARC has recently reviewed the animal, human, and other relevant experimental data on silica in order to critically evaluate and classify the cancer causing potential. Based on its review, IARC classified crystalline silica as a group 2A carcinogen (probable human carcinogen).

The OSHA permissible exposure limit (PEL for cristobalite is 0.05 mg/m3 (respirable dust). The ACGIH threshold limit value (TLV) for cristobalite is 0.05 mg/m3 (respirable dust) (ACGIH 1991-92). Use NIOSH or MSHA approved equipment when airborne exposure limits may be exceeded. The minimum respiratory protection recommended for given airborne fiber or cristobalite concentrations are:

CONCENTRATION

Concentration	Personal Protective Equipment
0-1 fiber/cc or 0-0.05 mg/m^3 cristobalite (the OSHA PEL)	Optional disposable dust respirator (e.g. 3M 9970 or equivalent).
Up to 5 fibers/cc or up to 10 times the OSHA PEL for cristobalite	Half face, air purifying respirator equipped with high efficiency particulate air (HEPA) filter cartridges (e.g. 3M 6000 series with 2040 filter or equivalent).
Up to 25 fibers/cc or 50 times the OSHA PEL for cristobalite (2.5 mg/m^3)	Full face, air purifying respirator with high efficiency particulate air (HEPA) filter cartridges (e.g. 3M 7800S with 7255 filters or equivalent) or powered air purifying respirator (PARR) equipped with HEPA filter cartridges (e.g. 3M W3265S with W3267 filters or equivalent).
Greater than 25 fibers/cc or 50 times the OSHA PEL for cristobalite (2.5 mg/m^3)	Full face, positive pressure supplied air respirator (e.g. 3M 7800S with W9435 hose & W3196 low pressure regulator kit connected to clean air supply or equivalent).

If airborne fiber or cristobalite concentrations are not known, as minimum protection, use NIOSH/MSHA approved half face, air purifying respirator with HEPA filter cartridges.

Insulation surface should be lightly sprayed with water before removal to suppress airborne dust. As water evaporates during removal, additional water should be sprayed on surfaces as needed. Only enough water should be sprayed to suppress dust so that water does not run onto the floor of the work area. To aid the wetting process, a surfactant can be used.

After RCF removal is completed, dust suppressing cleaning methods, such as wet sweeping or vacuuming, should be used to clean the work area. If dry vacuuming is used, the vacuum must be equipped with HEPA filter. Air blowing or dry sweeping should not be used. Dust suppressing components can be used to clean up light dust.

Product packaging may contain product residue. Do not reuse except to reship or return Ceramic Fiber products to the factory.

HIGH PRESSURE GAS CYLINDERS

GENERAL PRECAUTIONS FOR HANDLING AND STORING HIGH PRESSURE GAS CYLINDERS

- Edited from selected paragraphs of the Compressed Gas Association's "Handbook of Compressed Gases" published in 1981
  Compressed Gas Association
  1235 Jefferson Davis Highway
  Arlington, Virginia 22202
  Used by Permission

1. Never drop cylinders or permit them to strike each other violently.
2. Cylinders may be stored in the open, but in such cases, should be protected against extremes of weather and, to prevent rusting, from the dampness of the ground. Cylinders should be stored in the shade when located in areas where extreme temperatures are prevalent.
3. The valve protection cap should be left on each cylinder until it has been secured against a wall or bench, or placed in a cylinder stand, and is ready to be used.
4. Avoid dragging, rolling, or sliding cylinders, even for short distance; they should be moved by using a suitable handtruck.
5. Never tamper with safety devices in valves or cylinders.
6. Do not store full and empty cylinders together. Serious suckback can occur when an empty cylinder is attached to a pressurized system.
7. No part of cylinder should be subjected to a temperature higher than 52°C (125°F). A flame should never be permitted to come in contact with any part of a compressed gas cylinder.
8. Do not place cylinders where they may become part of an electric circuit. When electric arc welding, precautions must be taken to prevent striking an arc against the cylinder.

ATEX CLARIFICATION

ATEX COMPLIANT GAS ANALYSIS PERFORMED WITHIN A FLAMEPROOF ENCLOSURE

Special conditions apply to using a flameproof enclosure analyzer under the scope of the “European Directive for Equipment used in Explosive Atmosphere” (Directive 94/9/EEC; ATEX). To stay compliant to the directive please consider the following clarification sheet released by the European ATEX Notified Body Group:

E_xNB	Co-ordination of Notified Bodies Electrical Equipment for use in potentially explosive atmospheres on Council Directive 94/9/EEC	EOTC/00/007 Issued: February 10, 2000 CS/99/06/069

European ATEX Notified Bodies Group

Interpretation/Clarification Sheet N° 99/06/069/CS Edition 1.0

Original in English

Status :	Step* 5.2.1■	question ExNB/98(EECS)002	Date : 20/04/98
	Step* 5.2.3■	proposal **Proposer :** DMT	Date : 05/06/98
	Step* 5.2.4■	**Received for publication**	Date : 15-16/06/99

*Step refers to ExNB Rules

■ authorised **Chairman : M. BRÉNON**

Date of application : 16/06/99 **Signature :**

SUBJECT : **EN 50018 : 1994** **Gas analysis performed within a flameproof enclosure**

Question : ***What restrictions are necessary on the contents of the gas system/process line in order to validate the use of « Flameproof Enlcosure » as the protection concept.***

Answer :

1 Oxygen shall be present in the process line only as a constituent of an inert/oxygen gas mixture of which the oxygen represents no more than that normally present in air.

2 The gas mixture in process line shall not be within the explosive limits continuously, for long periods or frequently.

If the gas mixture is above UEL in normal service, gas leakage into the main enclosure due to failure of the gas containment shall not remain undetected for long periods.

If the gas mixture is above UEL in normal service and if the gas measuring system contains potential ignition sources (e.g. heated wires) in the process line, the line shall be purged with process gas before the measuring system is activated and the measuring system shall be de-activated before shut down of the process.

3 If the pressure in the process line in normal operation is higher than 1.1 bar, the following applies :

3.1 The gas mixture shall not be within the explosive limits in normal operation. This can be realized e.g. by purging the line with process gas or with inert gas before the measuring system is actived.

3.2 Even in case of total leakage of the gas containment, the pressure in the main enclosure shall not be higher than 1.1 bar.

3.3 The process line shall not contain potential sources of ignition and, taking into account the maximum pressure in service, the breathing devices shall be tested with respectively precompressed mixtures.

This ExNB Interpretation/Clarification Sheet has the sole purpose of clarifying the application of the EN Standards and/or of the requirements of Directive 94/9/EC and related documents. It does not in any way change the content of the standards and/or of the requirements. It remains valid until an official answer is received from the European Commission or the relevant standardization bodies.

ExNB93/S87/Autres

Appendix B SPA with HART Alarm

Overview . . . . . **page B-1**
Description . . . . . **page B-1**
Installation . . . . . **page B-2**
Setup . . . . . **page B-2**

OVERVIEW

This section describes the SPA with HART Alarm option for the Hazardous Area OCX 8800.

DESCRIPTION

The Moore Industries SPA with HART Alarm, Figure B-1, is a 4-wire (line or mains powered), site-programmable, digital process alarm. It connects to a standard HART field device, and provides up to four, fully configurable, contact-closure outputs based on readings of the HART digital data. The four Hazardous Area OCX 8800 alarm outputs recognized by the SPA are Low O_2, High COe, Calibration Status, and OCX Unit Failure.

Figure B-1. SPA with HART Alarm

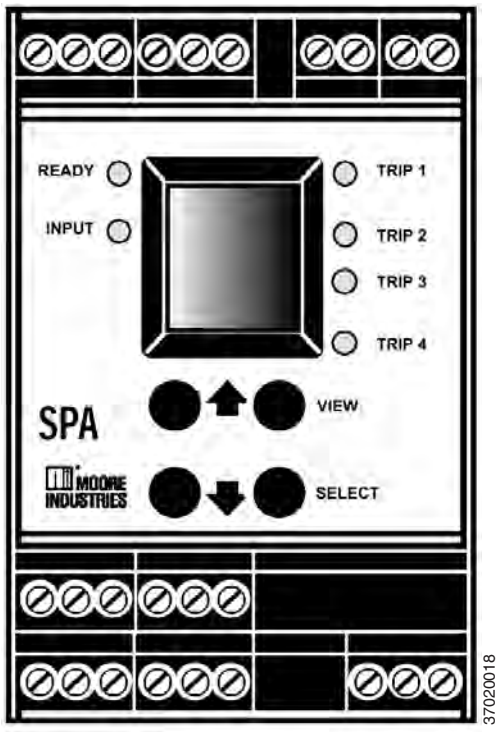
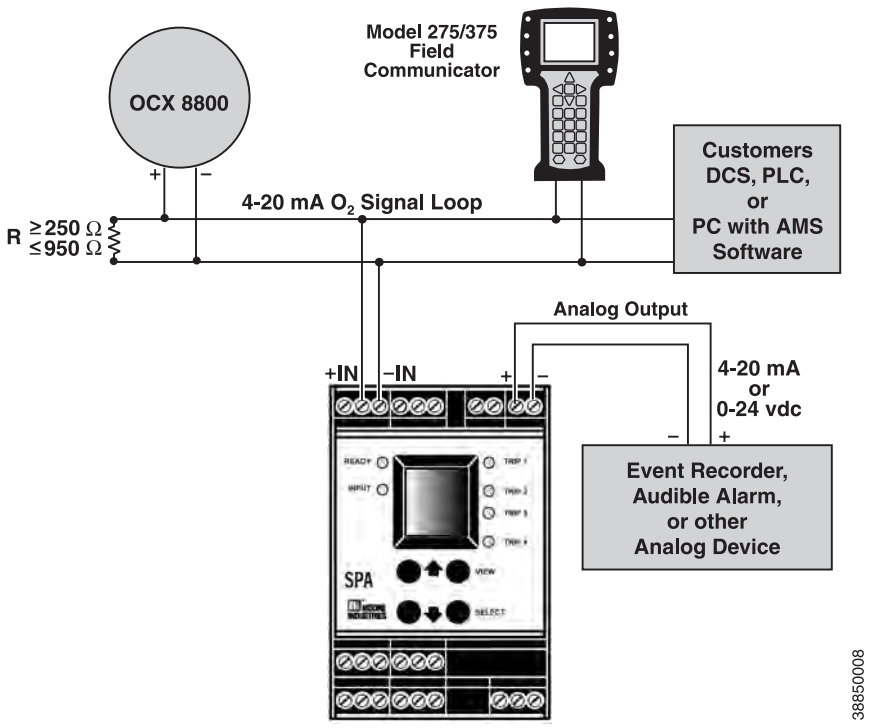


Figure B-2. OCX 8800 and SPA Interface Connections



INSTALLATION

Refer to Figure B-2 for the typical interface connections for the Hazardous Area OCX 8800 and the SPA with HART alarm. Refer to the Moore Industries SPA user's manual for additional information concerning SPA installation, setup, and operation.

SETUP

Setup of the SPA for communication with the Hazardous Area OCX 8800 includes setting internal jumpers and dip switches and configuring the SPA operating parameters via a menu-driven selection and calibration procedure.

Jumper and Switch Settings

SPA jumper and switch settings are shown in Figure B-3. If the SPA with HART was factory-configured by Emerson Process Management for operation with your Hazardous Area OCX 8800, jumper and switch setting adjustments are not required. However, you may use the following procedure to verify that the jumper and switch settings are correct. Adjust or verify jumper and switch settings as follows:

⚠CAUTION

Electrostatic discharge (ESD) protection is required to avoid damage to the SPA electronic circuits.

1. Refer to Figure B-3. Turn the SPA over and slide the access cover out. Before changing any jumper or switch position, take adequate precautions to avoid an electrostatic discharge.

Figure B-3. SPA Jumper and Dip Switch Settings

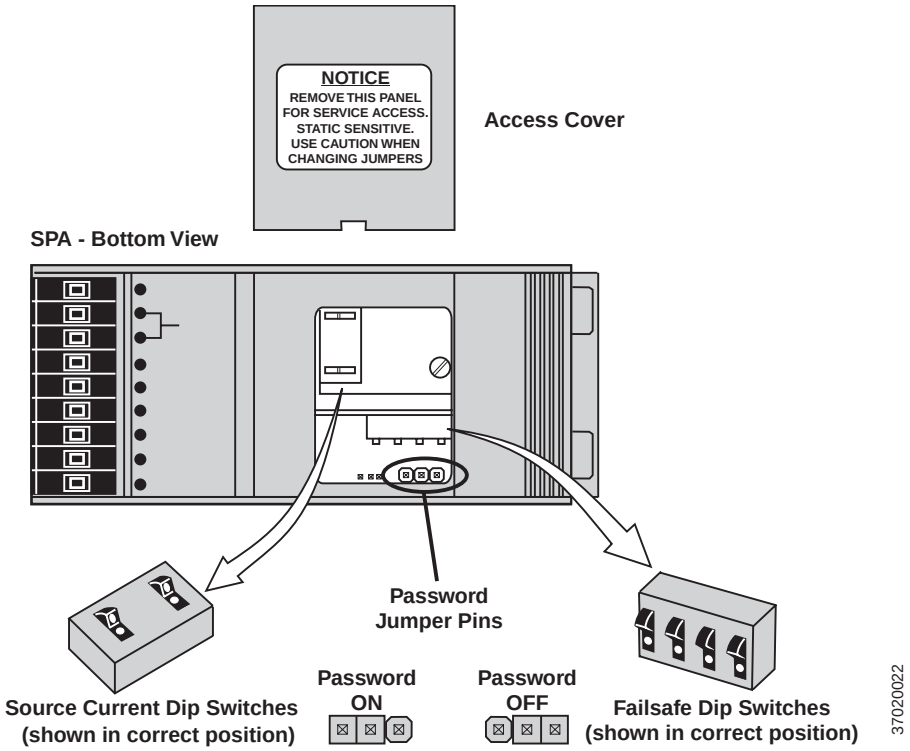
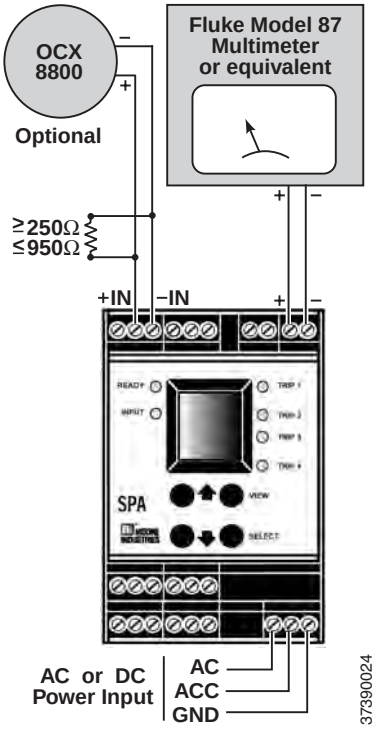

NOTICE
REMOVE THIS PANEL FOR SERVICE ACCESS. STATIC SENSITIVE. USE CAUTION WHEN CHANGING JUMPERS
Access Cover
SPA - Bottom View
Password Jumper Pins
Source Current Dip Switches (shown in correct position)
Password ON
Password OFF
Failsafe Dip Switches (shown in correct position)
37020022

Figure B-4. SPA Setup for Calibration



2. Verify that the Password Jumper is set to the OFF position. If the jumper is in the ON position, reposition the jumper.
3. Check the position of the Failsafe Dip Switches. Position the dip switches as shown in Figure B-3.
4. Check the position of the Source Current Dip Switches. Position the dip switches as shown in Figure B-3.
5. Reinstall the SPA access cover.

Configuration/Calibration

Prior to operation, the SPA operating parameters must be configured via a menu-driven setup procedure. At the end of the configuration procedure, the SPA analog output signal is calibrated to insure valid communications.

1. See Figure B-4. Connect a calibrated ammeter (Fluke Model 87 or equivalent, accurate to ±0.025%) to the SPA analog output terminals. Observe polarity.
2. Connect a 90 to 260 VAC or 22 to 300 VDC power source to the SPA power terminals. When connecting an AC power source, use the AC and ACC (AC Common) terminals. For a DC source, use the AC and Ground terminals.
3. If desired, you can connect the 4 to 20 mA O2 signal wires from the Hazardous Area OCX 8800 analog output terminal block to the SPA Input terminals. (The OCX must be operational to transmit the O2 signal. Observe polarity.)

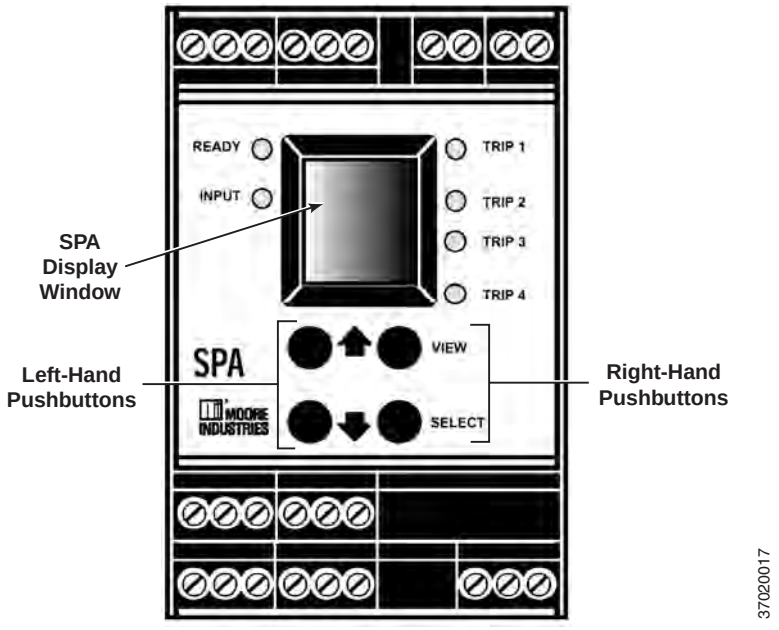
NOTE
The O_2 signal connection is not required for SPA configuration or calibration. The OCX interface will allow you to observe the O_2 signal level when the SPA configuration procedure is completed.

4. Observe the front panel of the SPA, Figure B-5:
   a. A process value display in the SPA display window indicates that the SPA is operational. Four pushbuttons are located below the display window.
   b. Pressing a left-hand pushbutton scrolls up (↑) or down (↓) through the SPA command menu, a submenu, or parameter values list.
   c. Pressing the VIEW pushbutton displays rail limits and alarm relay configurations. There are five sequential displays in the VIEW mode. While in the VIEW mode, the up (↑), down (↓), and SELECT pushbuttons are disabled.

NOTE
In the VIEW mode, you can scroll through and display the output zero and full scale settings and the alarm relay trip points and configurations.

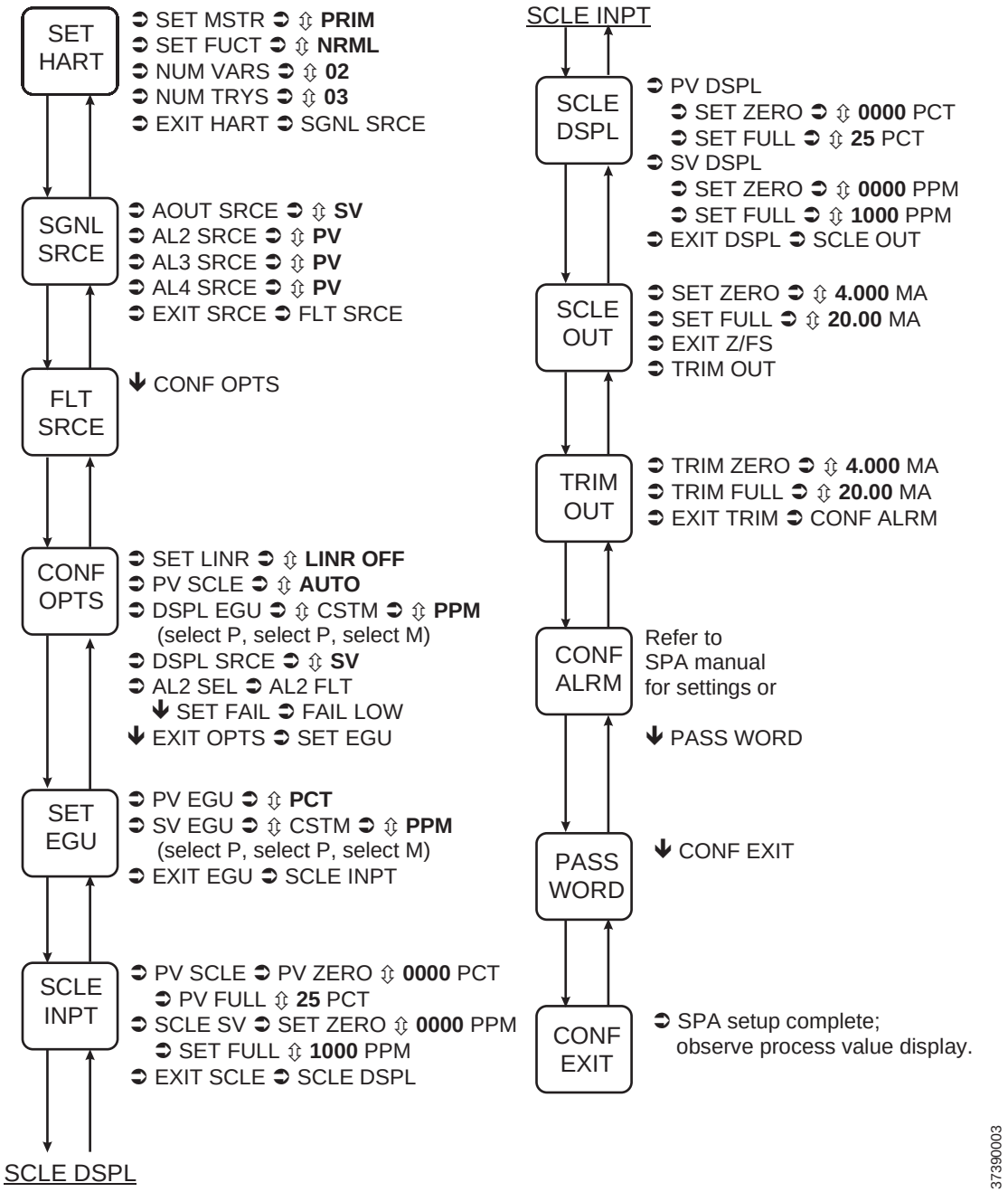
   d. Pressing the SELECT pushbutton selects the displayed menu or submenu command or selects a displayed parameter variable.

Figure B-5. SPA Front Panel



5. Figure B-6 shows the SPA menu, submenus, and parameter values that must be selected to configure the SPA for use with the Hazardous Area OCX 8800. Use the following instructions and selections shown to properly configure the SPA.
   a. Press the SELECT pushbutton. Observe the display window on the SPA front panel. The display window should read SET HART.
   b. See the SET HART command in Figure B-6. To the right of the command window is the SET HART submenu and related parameter values that must be selected via the front panel pushbuttons on the SPA.
   c. In the submenu views shown:
      ↓ means press the down pushbutton.
      ↑ means press the up pushbutton.
      ↵ means press the SELECT pushbutton one time.
      ⇳ means press the ↓ or ↑ pushbutton until the desired parameter value is shown in the SPA window.
   d. Proceed through the SPA menu, selecting the menu commands and parameter values indicated. After completing the sequence in the first column, go to the top of the second column and continue.
   e. To exit the menu, repeatedly press SELECT to display any main menu command. Then, press ↓ or ↑ until CONF EXIT is displayed. Select CONF EXIT.
   f. Detailed instructions concerning the configuration menu and the submenu structure for each main command are provided in the SPA user's manual.

Figure B-6. SPA Configuration Menu for Hazardous Area OCX 8800 Communication


SET HART
➲ SET MSTR ➲ ⇳ **PRIM**
➲ SET FUCT ➲ ⇳ **NRML**
➲ NUM VARS ➲ ⇳ **02**
➲ NUM TRYS ➲ ⇳ **03**
➲ EXIT HART ➲ SGNL SRCE
SGNL SRCE
➲ AOUT SRCE ➲ ⇳ **SV**
➲ AL2 SRCE ➲ ⇳ **PV**
➲ AL3 SRCE ➲ ⇳ **PV**
➲ AL4 SRCE ➲ ⇳ **PV**
➲ EXIT SRCE ➲ FLT SRCE
FLT SRCE
🡻 CONF OPTS
CONF OPTS
➲ SET LINR ➲ ⇳ **LINR OFF**
➲ PV SCLE ➲ ⇳ **AUTO**
➲ DSPL EGU ➲ ⇳ CSTM ➲ ⇳ **PPM**
(select P, select P, select M)
➲ DSPL SRCE ➲ ⇳ **SV**
➲ AL2 SEL ➲ AL2 FLT
🡻 SET FAIL ➲ FAIL LOW
🡻 EXIT OPTS ➲ SET EGU
SET EGU
➲ PV EGU ➲ ⇳ **PCT**
➲ SV EGU ➲ ⇳ CSTM ➲ ⇳ **PPM**
(select P, select P, select M)
➲ EXIT EGU ➲ SCLE INPT
SCLE INPT
➲ PV SCLE ➲ PV ZERO ⇳ **0000** PCT
➲ PV FULL ⇳ **25** PCT
➲ SCLE SV ➲ SET ZERO ⇳ **0000** PPM
➲ SET FULL ⇳ **1000** PPM
➲ EXIT SCLE ➲ SCLE DSPL
SCLE DSPL
SCLE INPT
SCLE DSPL
➲ PV DSPL
➲ SET ZERO ➲ ⇳ **0000** PCT
➲ SET FULL ➲ ⇳ **25** PCT
➲ SV DSPL
➲ SET ZERO ➲ ⇳ **0000** PPM
➲ SET FULL ➲ ⇳ **1000** PPM
➲ EXIT DSPL ➲ SCLE OUT
SCLE OUT
➲ SET ZERO ➲ ⇳ **4.000** MA
➲ SET FULL ➲ ⇳ **20.00** MA
➲ EXIT Z/FS
➲ TRIM OUT
TRIM OUT
➲ TRIM ZERO ➲ ⇳ **4.000** MA
➲ TRIM FULL ➲ ⇳ **20.00** MA
➲ EXIT TRIM ➲ CONF ALRM
CONF ALRM
Refer to
SPA manual
for settings or
🡻 PASS WORD
PASS WORD
🡻 CONF EXIT
CONF EXIT
➲ SPA setup complete;
observe process value display.
37390003

Appendix C Return of Materials

RETURNING MATERIAL

If factory repair of defective equipment is required, proceed as follows:

1. Secure a return authorization number from an Emerson Process Management sales office or representative before returning the equipment. Equipment must be returned with complete identification in accordance with Emerson Process Management instructions or it will not be accepted.

   In no event will Emerson Process Management be responsible for equipment returned without proper authorization and identification.
2. Carefully pack defective unit in a sturdy box with sufficient shock absorbing material to ensure that no additional damage will occur during shipping.
3. In a cover letter, describe completely:
   a. The symptoms from which it was determined that the equipment is faulty.
   b. The environment in which the equipment has been operating (housing, weather, vibration, dust, etc.).
   c. Site from which equipment was removed.
   d. Whether warranty or nonwarranty service is requested.
   e. Complete shipping instructions for return of equipment.
   f. Reference the return authorization number.
4. Enclose a cover letter and purchase order and ship the defective equipment according to instructions provided in Emerson Process Management Return Authorization, prepaid, to:

   Emerson Process Management
   RMR Department
   Daniel Headquarters
   11100 Britmore Park Drive
   Houston, TX 77041

If warranty service is requested, the defective unit will be carefully inspected and tested at the factory. If failure was due to conditions listed in the standard Rosemount Analytical warranty, the defective unit will be repaired or replaced at Emerson Process Management's option, and an operating unit will be returned to the customer in accordance with shipping instructions furnished in the cover letter.

For equipment no longer under warranty, the equipment will be repaired at the factory and returned as directed by the purchase order and shipping instructions.

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WARRANTY

Rosemount Analytical warrants that the equipment manufactured and sold by it will, upon shipment, be free of defects in workmanship or material. Should any failure to conform to this warranty become apparent during a period of one year after the date of shipment, Rosemount Analytical shall, upon prompt written notice from the purchaser, correct such nonconformity by repair or replacement, F.O.B. factory of the defective part or parts. Correction in the manner provided above shall constitute a fulfillment of all liabilities of Rosemount Analytical with respect to the quality of the equipment.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF QUALITY WHETHER WRITTEN, ORAL, OR IMPLIED (INCLUDING ANY WARRANTY OF MERCHANTABILITY OF FITNESS FOR PURPOSE).

The remedy(ies) provided above shall be purchaser's sole remedy(ies) for any failure of Rosemount Analytical to comply with the warranty provisions, whether claims by the purchaser are based in contract or in tort (including negligence).

Rosemount Analytical does not warrant equipment against normal deterioration due to environment. Factors such as corrosive gases and solid particulates can be detrimental and can create the need for repair or replacement as part of normal wear and tear during the warranty period.

Equipment supplied by Rosemount Analytical Inc. but not manufactured by it will be subject to the same warranty as is extended to Rosemount Analytical by the original manufacturer.

At the time of installation it is important that the required services are supplied to the system and that the electronic controller is set up at least to the point where it is controlling the sensor heater. This will ensure, that should there be a delay between installation and full commissioning that the sensor being supplied with ac power and reference air will not be subjected to component deterioration.

Hazardous Area OCX 8800

Instruction Manual
IM-106-880C, OI
September 2009

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HART is a registered trademark of the HART Communications Foundation.
All other marks are the property of their respective owners.

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